FACTORY
MANAGEMENT and MAINTENANCE

MAY, 1935

L. C. MORROW
Editor

New NIRA

APPARENTLY there is to be a new NIRA. Some industries want it; some do not. But none of them wants the Black 30-Hour Week bill or the Wagner Labor Relations bill, one or both of which it seems likely that labor will be able to push over if a new NIRA does not provide a satisfactory substitute.

This situation calls for a consideration of the bill for a new two-year NIRA introduced by Senator Pat Harrison, Chairman of the Senate Finance Committee (S2445). The new bill follows the old as to general objectives but contains several significant differences as to detail.

CODES in effect on June 16, 1935, must be reopened by the President, who will have the right to cancel, modify, and change codes or orders without consent of the industry. Three months are allowed for the reconsideration.

Companies will be required to keep special books "for the protection of consumers, competitors, employees, and others." These books must be open to government inspection.

Section 7(a), which said in the old bill, "shall contain the following conditions," says in the Harrison bill, "shall contain the following statement of rights of employees, which are hereby declared and affirmed."

The original act was designed to meet an existing emergency. The new act states, as an additional purpose, "to prevent the recurrence of such emergencies," also omits to provide for the ending of the act in case the emergency ends before June 16, 1937.

"Minimum wages" is a term used throughout the new bill. Under the existing bill, the recovery administration has limited its activities to securing "minimum wage rates."

In the proposed bill, "The minimum wages so provided for may be differentiated according to experience or skill of the operators, locality of employment, or other applicable considerations."

There is a requirement in the Harrison bill that all suppliers to the government must file certificates of compliance for themselves and for their supplies.

In limited, or imposed, codes the hours of work per week may be specified (not by the industry, but by the administration).

Employees, or their representatives, may cite an employer for alleged violations of the code or the act. The employees, or representatives, shall not be assessed costs at any stage of the proceedings except on appeals; and damages, as well as back wages, can be collected from the employer.

There are other provisions that could be pointed out as potential disturbers of industry and industrial relations. But enough have been cited to indicate the necessity for a very careful examination of the bill and the desirability for industry to voice its dissension or concurrence.

IT IS our opinion that the several provisions outlined in preceding paragraphs:

Permit unnecessarily broad powers to the President or his delegates to change or impose codes, including the power to impose labor provisions.

Open the door to almost unlimited governmental investigation into the affairs of any industrial concern.

Establish a labor bill of rights. Seem to exclude the writing of a merit clause into the labor provisions of any code.

Tend too strongly toward a permanent act.

Pave the way for guaranteed weekly or annual wages.

Set up multiple wage minimums, which would result in endless controversy.

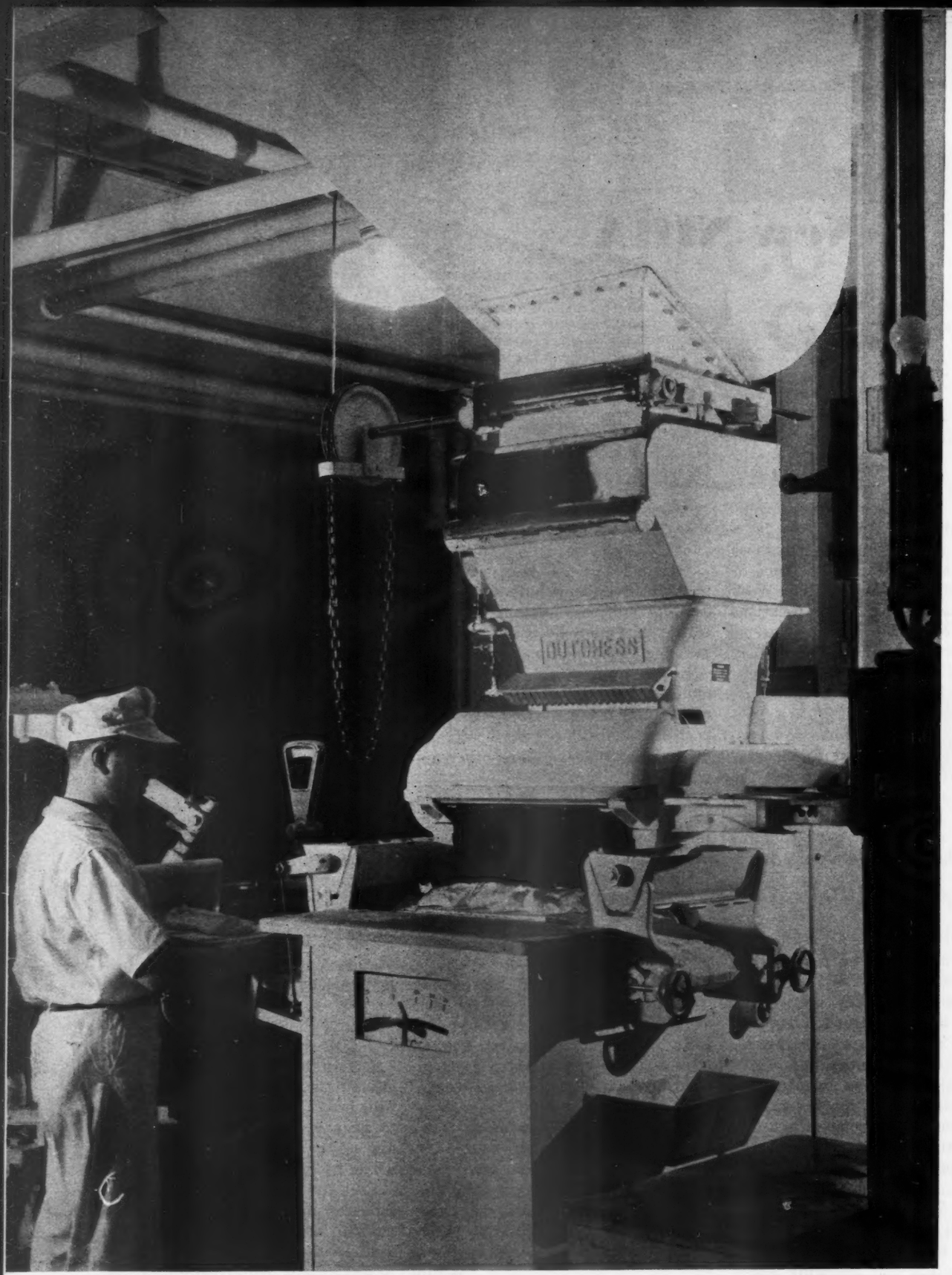
Endorse the blue eagle boycott of the early days of PRA.

Make possible, in imposed codes, the establishment of a 30-hour week. (If 30 hours were specified as the minimum hours per week, labor would disregard the maximum, demand 30.)

Put too great power into the hands of disgruntled employees and professional unions.

SENATOR Harrison has stated that his bill was offered as a basis for discussion. This is a direct invitation to industry to propose its own substitutes for any of the provisions of the bill to which it objects.

Certainly it is the obligation of industry to understand the bill as written and make constructive suggestions as to regulations that will be less drastic, more favorable to recovery, better suited for permanent legislation when and if the time for it arrives. In formulating its suggestions, industry must keep in mind the likelihood of being saddled with drastic labor laws unless a NIRA that is generous to labor is evolved and passed.



Dough divider, The Williams Bakery, Wilkes-Barre, Pa. Rittase photograph

"The story is always the same. Every method or device that reduces cost gives employment to additional workers in time—usually in a short time." For further proof, out of the pages of industrial history, see C. Oliver Wellington's article, page 199. In the bakery industry, for instance, mechanization has meant wider distribution of better product at lower cost

How Do You Buy?

As to supplies and equipment, the industrial distributor may help you keep manufacturing costs low

L. C. MORROW
Editor

I THINK that the manufacturing industries are pretty well in agreement on one major principle of economics. It is that cost of production must be as low as possible in the interest of wide distribution. Which is one way of saying that the lower the production cost achieved, the lower the selling cost can be, and therefore the greater the number of people who can buy.

When he thinks of production cost no manufacturer ever overlooks the cost of labor, or the cost of materials, or the cost of overhead. Some manufacturers do overlook power costs, or maintenance costs, or other costs of similar importance.

The Cost of Buying

Among the costs to which too little attention is paid by too many manufacturers is the cost of buying. I don't mean primarily the cost of interviewing, the cost of writing orders, the cost of checking invoices, and the like — although those costs count. I mean the cost of the method of buying.

Specifically, I am thinking about the position of the industrial distributor in the scheme of things. And I am wondering if, all too often, the manufacturer makes use of him or not without fully understanding why.

So I am proposing that he become acquainted with the basis upon which the distributor engages in business and then determine the extent to which he can use the distributor's services to his own advantage.

In the abstract, the user of industrial supplies reimburses the maker of those supplies for the cost of distribution. The average maker of industrial supplies has about 94,000 consumer prospects, according to *Mill Supplies*. At $5 per consumer call, making six calls a year, annual sales expense would be close to $3,000,000. Quite a bill for the users to pay—and a very strong argument in justifying the industrial distributor.

Why? Because the distributor concentrates as to territory, spreads expense over many lines, represents many items on each call. The average distributor serves 1,380 industrial plants. He carries about 30 per cent of the maker's stock burden. Actual survey figures show that the maker of industrial supplies carries a stock worth $55,000 when he sells through distributors; $78,000 when he sells direct—an increase of 41 per cent.

In terms of the manufacturing industries as a whole, the 3,000 makers of industrial supplies would have an additional bill for interest alone of around $4,000,000 if they sold direct.

Now take the distributor out of the picture. Ask the supply makers how much they would have to increase their sales forces. The figures they give you will average 321 per cent (*Mill Supplies* survey). You'll find that several manufacturers have said 1,000 per cent.

The Cost of Selling

Nosing into supply manufacturers' records shows us that the average size of the orders the supply manufacturer receives from the distributor is $182, from the user direct $27 —a ratio of 7 to 1. We can't deny that it costs less to handle one order than seven.

But suppose the user of supplies carries the stocks. Twenty-five case studies develop the fact that the higher the rate of turnover the lower the carrying costs. One plant shows a turnover rate of 0.4, a stock-carrying cost of 62 per cent. (Add 62c. to every dollar's worth of supplies carried.) Another plant shows a turnover rate of 10.8, a carrying cost of 7½ per cent.

The case studies show that 50c. must be added to the purchase price of every $100 worth of stock for each month it remains in the storeroom. The plant with 0.4 turnover had to pay 14c. interest charges per dollar of stock, the plant with 10.8 turnover only ½c. per year.

These charges took no account of obsolescence and depreciation. Frank Parish, supervisor of inventories, U. S. Steel Corporation, says that industrial supply stocks depreciate 20 per cent per year and that the carrying charges are 10 per cent.

Cost $110, Worth $80

On that basis $100 worth of stock at the end of a year has cost $110, is worth $80; at the end of five years the figures are $137.50 and $32.76. To retain these values, the supplies must remain serviceable; if obsolete, they must be written down to scrap value.

The analyst may stop right here if he likes, because he will be able to make out his own case for or against the distributor on the basis of the points already raised. But should he care to go the whole route, he must consider still other items. He must reach conclusions concerning:

The size of the inventory of industrial supplies that he will have to carry to insure against production delays as a result of breakdown.

Night, Sunday, and holiday service by distributor.

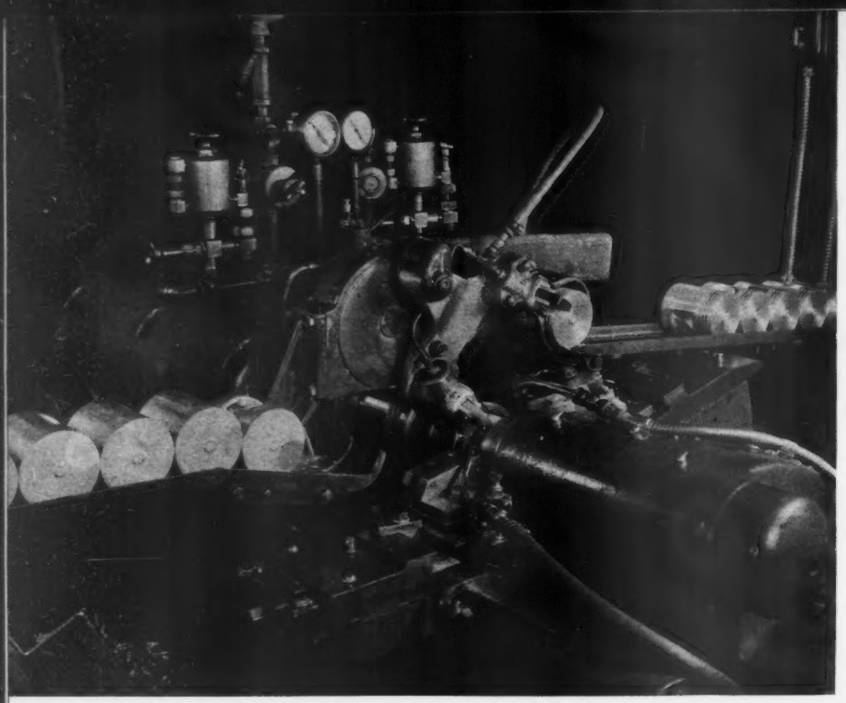
Obligations that he may have to buy from distributor normally, as well as in emergency, to keep him on the job.

Whether or not distributor services keep down expenses incident to stock storage for items such as rent, light, heat, insurance, taxes, cleaning, transportation, handling, purchasing, paying bills.

And there are other considerations that he will discover for himself.

Suggestions as to influence of distributors upon cost are contained in

(Continued on advertising page 55)



Manufacturers who have not gone into the market for new production equipment since 1929 or 1930 are overdue for a big surprise. Here, for example, is a machine that picks up a piston from the feed chute, places it in working position, surfaces the outside, mills it, cuts the ring slots, and removes it to a take-away chute

Millions for Equipment

Not one cent for waste. Packard One Twenty methods reflect best in current management practices

ALVAN MACAULEY
President, Packard Motor Car Company
Detroit

Standard Packard practice is to hone crankshaft journals by rubbing against stones that must be constantly adjusted. The same results are accomplished on the new car by using a machine that polishes the journals on continuous strips of crocus cloth, unreeled from a spool and running into a waste can. No stopping to change and dress stones

WE DECIDED more than a year ago to add to our lines another car that would be a truly fine car but could also be sold in a much lower price class. All motor cars are so good that to design and build a new one with added values, we knew, represented a real task. We felt, however, that we were peculiarly fitted for this job and knew there were a number of circumstances that would be helpful.

Although continuing to increase our proportion of available business in the fine car field and actually obtaining nearly half of it, we had considerable productive facilities that could be utilized for the new car. In our planning we considered that necessary rearrangement would give us ample space ideally laid out for the manufacture of the new car in volume and be helpful, through increased efficiency, in the production of our larger cars. At the same time we knew that there were available and waiting production tools far better than any on the market just a few years ago.

Studies disclosed that our equipment in many important manufacturing processes was ample to care for our larger cars and the new one as well. This was particularly true in such departments as foundries, forge shops, heat treating, screw machining, woodworking, stamping, die and tool making, and plating.

Things Needed

We found we would need completely new body assembly shops, divisions for machining the metal elements, and assembly departments. Here new machine tools and conveyor equipment would be of major importance.

We were, in fact, relying heavily on the reputed advancement in machinery and conveyors to permit us to turn out at a price far below anything in our history a new automobile that would measure up to the standards to which Packard has always rigidly held. Just where we could rely upon this development of new machinery to carry us, just how much of our problem would thereby be solved for us, we did not definitely know. Of course we knew that we must do the major job by

competent design and by ingenious application of equipment to the problem in hand.

Credit Where Due

Well, we came to designing the new car and planning its production. It became quickly apparent that the new car could be sold at a price that would bring it entirely out of the Packard price class, without for an instant compromising with Packard quality standards. And—without detracting from the achievement of the engineers in designing the car and working out its production problems—it must be admitted that a good deal of the credit for this must go to the equipment makers.

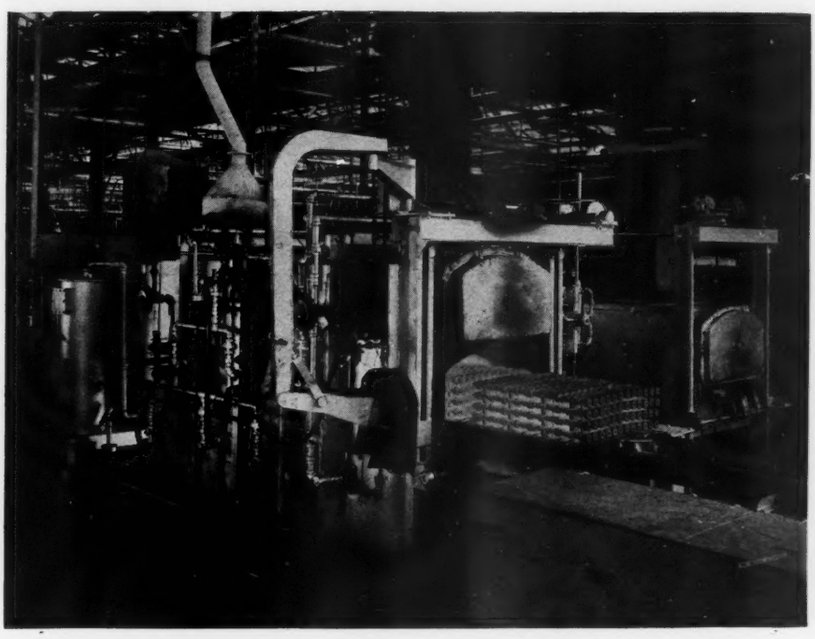
If you have not gone into the market for new production equipment since 1929 or 1930, you, too, are overdue for a genuine surprise. Visitors to our new One Twenty plant are amazed. It is not just one big improvement, nor an assortment of small improvements. Rather is it a collection of improvements large and small.

For example, there are the huge body welders. Into one of these machines the workmen place the major panels. Then the machine begins its welding. In a few seconds these parts are welded together into a body which for all practical purposes is now a single shell of steel.

Or consider the multiple-operation metal-cutting and drilling machines. Some such machines are simultaneously handling all cuts on a sizable piece, thus reducing costs and assuring absolute accuracy of each surface or hole in respect to every other. There are several machines that drill a score of holes at a time, from many different directions.

Automaticity

Another machine surfaces the outside of a piston, mills it, and cuts the ring slots—picking up the piston from a feed chute, placing it in working position, removing it to a take-away chute, and simultaneously placing the next piston in the fixture.



Camshafts used to make costly trips across the street to heat-treating and back again. "Why not put heat-treating furnaces right in the machine line?" somebody asked. So right in the line they are—three of them. Note the mechanical charger that pushes the load of camshafts inside the oven with one thrust

Of course these improvements in manufacturing method did not just come about through the functioning of nature. They were planned and laid out with the greatest of care. And the design of the new product itself was so worked out as to take advantage of every such opportunity, as well as other opportunities for saving that could be had regardless of the production equipment.

Here is an instance. On the big Packard line, all crankshafts are machined all over. The counterweights are made separately, machined, and attached to the shaft by an ingenious—and rather expensive—method involving dozens of operations. It makes a crankshaft to delight the heart of a man who loves beautiful metal-working, though he is unlikely ever to see it so long as it functions satisfactorily.

On the new car, the crankshaft is of equally good design, of identical steel, forged by the same methods, heat treated to the same formula. There are, however, changes that are important in reducing the cost although affecting the engine not at all. The new car's crankshaft, including counterweights, is forged all in one piece. The journals are machined and polished as precisely as ever. The counterweights, however, following general practice with other cars, are as they came from the forging hammer. And the cost of the shaft has been cut by a tremendous percentage.

Same Results, Lower Cost

Again, on this part comes an improvement of technique that reduces costs also without affecting quality. Our standard method of putting the finishing touches to crankshaft journals has always been to hone them on a machine that rubs the journal surfaces against stones. Keeping these stone surfaces adjusted has been expensive. On the new car, identical results are accomplished by using a machine that polishes the journals on a continuous strip of crocus cloth, unreeled from a feed spool and running after use into a waste can. This machine can operate continuously, eliminates all the fuss and feathers of stopping to change and dress stones.

There have been economies attained through layout changes. Camshafts, for instance. After these are forged they must be turned, heat treated, subsequently ground to the final finish. As we worked out the layout for the new car, we had too high a cost for our camshafts. Plans called for a trip from the forging hammers across a street to the heat-treating department, again across the street to the machining line for grinding—three trips of a good hundred feet.

"Why not put heat treating right

in the machine line?" somebody in the organization asked.

Three gas-fired furnaces are now right alongside the machine line. Furthermore, they are charged by a device operating on rails at right angles to the furnaces so that the carriage is loaded with shafts and wheeled into line with the furnace mouth. Then the whole load is mechanically pushed inside with one thrust. Guess how important an element this is in the cost of producing the camshaft, without any come-down in the standards of the finished part.

Nobody loves a plating department. It is generally admitted to be a mussy, smelly, sloppy section of the plant which is tolerated only because its product is essential. What Packard did to its plating department is therefore first-class management news. The story of its transformation is told in an early issue

Precision a Matter of Course

Some of the machine tools employed in producing this car are sufficiently ingenious to call forth the admiration of any metal-working enthusiast who sees them. Foremost among machines of this category is a battery of equipment that works on motor blocks—boring, milling, drilling and so on. These machines perform multiple tasks, and some of them are so designed that they work one job from one set of spindles, then permit a quick shift of the casting to another position where a second set of spindles gets to work.

The battery handles the entire operation from roughing out the casting to final polishing, and in no other plant is found greater precision. This, in fact, is one of the outstanding characteristics of much of the new machinery, that it turns out precision as a matter of course. Incidentally, this battery of machines is modernistic in appearance—and their beauty, something that has many features of practical value to us, was obtained at no additional cost in their manufacture.

In a previous article* there was described the method by which teletypewriters are used in our big car plant to schedule the work and keep it flowing. When we laid out the new car plant we took every advantage of this experience. The variations and permutations possible even in so standardized a product as an automobile are almost infinite. Some 30 sets of engine specifications are necessary, including assorted variations for export shipments to conform with foreign traffic laws and meet the requirements of foreign methods of taxation.

Comparable variations occur throughout. It is necessary to schedule the parts through the plant so that when they reach the assembly or sub-assembly lines, the right parts meet the right assemblies. All this is handled by teletypewriter. The process has been so far refined in this plant that one chain conveyor brings radiator shells, bonnets, front fenders and rear fenders—all in the proper order and at just the right moment.

Teletypewriters were used to schedule the work in the big car plant with such good effect that Packard engineers took every advantage of the experience in laying out the One Twenty plant. By this means the scheduling process has been so far refined that one chain conveyor brings radiator shells, bonnets, front and rear fenders—in proper order and at the right moment

It is ordinary to see here in sequence a tan shell, a blue front fender, a maroon bonnet, a black rear fender, and so on. It is all controlled from the planning of the sales department's needs, and the factory departments are linked with the office by teletypewriters so that the entire production performance is at all times coordinated.

More Car for Less Money

By now, you no doubt begin to see how and why we are producing a new automobile on which at this writing, in mid-March, we are more than one month behind delivery requirements. The cause of the value incorporated in the product is, as has been explained, not so simple that it can be attributed solely to new equipment, to product design, or to plant layout. It comes from a combination of these factors, and a dozen other contributing causes.

However attained, it has proved to our satisfaction that by developing a sufficiently good value and sufficiently attractive product it is possible even in these times to get a profitable volume of business—and thereby to bring into existence enough reemployment to make a sizable contribution to national recovery.

*Plant Geared to Sales, December, 1934, page 544.

New Social Security Bill

Passed by the House, now to be considered by the Senate. There is still time for industry to make its recommendations

G. CHAUNCEY PARSONS
Insurance Counselor, New York

MANY changes have been made in the new Social Security Bill (#H.R. 7260) passed by the House of Representatives on April 19, 1935, and only those parts affecting industry are discussed here.

The bill is split up very much from a legal angle, in an attempt to avoid unconstitutionality.

Title VII. A Social Security Board, which is to be an independent agency in the executive branch of the Government, is established. The board is to have three members, holding office for 6-year terms.

Title I. Grants in Aid to the Several States for Old Age Assistance. This title is not detailed, because there is no specific tax on industry.

Title II. A Federal Old Age Pension Plan. Effective January 1, 1937. Payable to those who have been employed in industry, and who, on or after January 1, 1942, reach age 65.

What the Worker Gets

Benefits are measured by the wages the worker has received during employment after January 1, 1937, up to the date of retirement. However, no wage or salary over $3,000 per year from one employer is considered. Benefits are not based on needs or dependency, but on wages.

All employees under sixty, as of January 1, 1937, are eligible to benefits regardless of salary or wage, or nature of work.

Exceptions: Agricultural workers, domestic servants, casual workers (this does not mean extra help taken on during rush seasons), steamship workers, Federal, state, and municipal employees, employees of strictly non-profit organizations (churches, charitable organizations, etc., qualifying under Section 101 (6)—Income Tax Rules of 1932).

Who Is Included

From this it can be seen that executives and white collar workers are included, as well as all railroad employees and those now covered by private plans.

Qualifications. Retirement age, 65, —both sexes, who have earned not less than $2,000, part of which was earned in the last five years before retirement. Payroll credit is given for such items as room, board, clothing, etc., as well as cash wages.

Title VIII. Taxes. Effective January 1, 1937. To be paid into the U. S. Treasury:

By Employee. An income tax on all wages and salaries received from an employer, up to $3,000 per annum. Collected by wage deduction as follows: 1937 to 1939 inclusive, 1 per cent of pay; 1940 to 1942, 1½ per cent; 1943 to 1945, 2 per cent; 1946 to 1948, 2½ per cent; 1949 and thereafter, 3 per cent.

What the Employer Pays

By Employer. An excise tax on all payrolls (salaries and wages) paid to each employee, up to $3,000 per year: 1937 to 1939 inclusive, 1 per cent of payroll; 1940 to 1942, 1½ per cent; 1943 to 1945, 2 per cent; 1946 to 1948, 2½ per cent; 1949 and thereafter, 3 per cent.

Exceptions—Same as in Title II.

Title III. Grants to the States for Unemployment Compensation. To those states that pass legislation acceptable to the "Social Security Board" certain grants will be made for administration purposes.

Further, when an acceptable unemployment compensation plan is made law—taxing all employers of labor within the state at least the minimum as required by the Federal Government—there is no maximum requirement—then the employers of that state will receive a credit up to 90 per cent of the new Federal excise tax for unemployment compensation, on taxes collected by the state for the unemployment fund.

(Continued on page 216)

Old Age Pension Benefits at Retirement

Average monthly salary	*Years of Employment*								
	5	10	15	20	25	30	35	40	45
$25	(1)	$15.00	$16.25	$17.50	$18.75	$20.00	$21.25	$22.50	$23.75
$50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00
$75	16.25	20.00	23.75	27.50	31.25	35.00	38.75	42.50	46.25
$100	17.50	22.50	27.50	32.50	37.50	42.50	47.50	51.25	53.75
$125	18.75	25.00	31.25	37.50	43.75	50.00	53.13	56.25	59.38
$150	20.00	27.50	35.00	42.50	50.00	53.75	57.50	61.25	65.00
$175	21.25	30.00	38.75	47.50	53.13	57.50	61.88	66.25	70.63
$200	22.50	32.50	42.50	51.25	56.25	61.25	66.25	71.25	76.23
$225	23.75	35.00	46.25	53.75	59.38	65.00	70.63	76.25	81.88
$250	25.00	37.50	50.00	56.25	62.50	68.75	75.00	81.25	85.00

(1) Lump sum payment of $52.50. The maximum pension is $85 per month. No joint-survivorship annuities.
Death benefits—before retirement, 3½ per cent of all wages received after January 1, 1937; after retirement, 3½ per cent of all wages received after January 1, 1937, less the total amount paid out in annuities.
Cash or Surrender Values—none. Benefits are in no way tied up to taxes (contributions). The benefits come from the U. S. Treasury.

They Know and Use

the newest and best in labor-saving equipment, machinery, and methods

Nuts and bolts have little decorative value, do not always stay put, sometimes are no better than they should be for light summer dresses. So welding is an important production ally in the manufacture of porch furniture. There are six spot welders, for example, in this production line. Men work in pairs; one assembles, the other welds. Result—lower operating costs, better product

At the J. R. Bunting Company, Philadelphia, portable electric tools make easy work of what would otherwise be the onerous job of cutting covers for porch gliders. With a power saw the operator can cut anywhere from ten to forty layers of cloth at one whack, the number depending upon size of order and thickness of material. One man in this well-lighted cutting room cuts specials, another sticks to linings. Six men get out regular orders

This concern makes everything that goes into a glider except the rubber tips that fit on the base of some models to keep them from "walking." Hence many metal forming and bending operations—ten, for instance, on this glider arm. The fact that they couldn't buy a pipe-bending machine to suit their special needs didn't prevent those responsible for low-cost operation in this plant from developing one of their own

Baking oven is gas fired, 300 feet long. Temperature is automatically regulated and controlled. It takes 70 minutes for parts to go through. The oven is so well insulated that all coil spring forming operations are carried on underneath it without physical discomfort to workers. From the oven, an overhead chain conveyor takes finished parts to assembly and shipping points. This moving job used to keep nine truckers busy

Finishing is a major step in glider manufacture. And since painting is never any better than the preparation of the surface for it, this concern gives special attention to that phase of the finishing problem. Here the same glider arm we have seen formed and welded across the page is spray painted. There are three spray booths, one oven, to handle chairs, glider arms, other parts

Photographs by Rittase, courtesy of The Sherwin-Williams Company

Larger parts like backs and spring seats for gliders are dipped. There are six dip tanks at the entrance to the baking oven, so it is only a moment's work to shift colors. Green is the favorite color, so the green tank is located closest to the oven entrance. Parts are hung at an angle on the oven conveyor to facilitate dripping. Excess paint goes back in the tank. Capacity, 330 backs an hour, 180 seats

Giving the Proverbial Hell

"Getting them told" is a hard job to do well, but the quiet manner is essential. Whatever you do, don't fly off the handle

CHARLES S. STEVENSON
General Manager, Hall Brothers, Inc.
Kansas City, Mo.

"ANYBODY can wave his arms and sound off when one of his men pulls a boner. The fellow who doesn't is the one we're after." I left the boss's office, crestfallen and disappointed.

A young shipping clerk, craning his neck as the boss and I were passing, had knocked open a sprinkler head with a ladder. Water coming down in torrents. Fire bell ringing. People running. I took "time out" to get him told. Later the boss called me in for a chat.

. . . I took time out to get him told

"Now, put yourself in that boy's place," he began. "Would *you* like to have somebody pounce on you about something you were no more anxious should happen than he? That young fellow's afraid of you now, but you're the one who pulled the real 'boner.'"

And he was right!

As an employee, I liked to *get* criticisms which would help me be ready when the time came for the foreman's job. As a foreman I liked to *give* criticisms that would make those under me do better, because if they didn't do a good job I couldn't expect to be rated as a good foreman. I soon discovered it isn't so much *what* is said, as *how* it is said.

And this, it seems to me, is the big thing you department heads should observe — the way you criticize.

The Technique of Criticism

The manager and I were inspecting the plant. A stock boy, impatient at the slowness of the freight elevator and unaware of our nearness, had raised the safety gate, stuck his head in the shaft, and was exhorting the operator to "get this thing down here or I'll come up after it."

The boss paused, half-smiled, and stepped over toward the boy who had hastily pulled down the gate and was trying to cover his embarrassment.

"Lad, how would your folks feel if you were brought home with your head smashed up?" he asked quietly.

"Oh, I had my eye on the elevator," defended the boy.

"Suppose one of those small dollies on the floor above had slipped under the gate?"

"Well, uh . . . mebbe . . . I really didn't think of that. Yes, sir! You're right, all right," he stammered.

As we started away, the boss turned, called:

"By the way, young man, what was the idea of sticking your head in that shaft?"

Making Criticism Pay

"Well, I'll tell you, Mr. Sexton. The service on that elevator is terrible. All the floors are hollering. It just takes too darn long to get things from one floor to another!"

"Got any ideas?"

"Yes, sir. The biggest delay is on the sixth floor. The operator spends too much time there. He has to push the boxes and supplies he takes off 'way over to the end of the room. While he pushes we wait. They need a stock boy for that floor. There's other things he could do that would help out, too."

"Well, we'll look into that"—to me. "Thank you!"—to the boy, and we departed.

So good a job of criticism that the boss got a profitable idea from it! Not only that but he used the incident for a gentle reprimand when he told me I really was to blame.

"You should have noticed that before," he chided.

•

Next Month—More Than My Hands Are Needed

Quite frequently production runs are so small that it is uneconomical to spend much money to improve the equipment. But as production increases additional expenditures may be warranted. Here, for example. Operation is riveting a molded plastic part to a metal stamping with a fibre insert between. Increased production justified installation of a four-spindle riveter to replace the old single-spindle machine. To avoid transfer of parts from cartons to bins, the latter were constructed to hold the entire carton. In back of the cartons are the bins for the stampings. Right in front of the operator is a shallow tray for the spacers. Back of the tray are openings for drop delivery chutes. Pieces are assembled on holding jigs. Riveting is actuated by a foot pedal control. The riveting machine indicates a trend on the part of machine manufacturers toward a better understanding of the value of applying motion economy principles to machine design

A Foreman Use Motion Study?

Absolutely. Economy of motion is primarily a function of his. Just show him where and how to begin

R. P. FOOSE
Industrial Engineer
Eagle Pencil Company, New York

IT HAS been the unfortunate experience of many a new tool of scientific management developed in recent years to be advertised as a panacea and used as the nucleus for high-pressure promotion schemes.

Motion study has not escaped this fate. Its application involves a thorough analysis of the situation; the use of common-sense principles of shop economics to the recommended improvement; a thorough selling job to executives, supervisors, and employees; and a carefully developed plan of teaching the approved method.

All of these necessary steps involve a considerable amount of time, and the waving of a magic wand in the hands of some pseudo-expert will only be a poor substitution. Then introduction of a motion study program in the shop does not require an expensive outlay for speed cameras, projectors, films, and lighting fixtures. These may be used for special purposes of group instruction and education, but they are in no way essential to the everyday program of large or small shops.

Out of the Laboratory

Motion study in itself is not new. Its fundamental principles were worked out years ago. However, the emphasis that is now being placed on needed manufacturing economies has transferred motion study from laboratory to shop.

All of which brings up the question: Can the foreman out in the shop use motion economy?

Yes, he can. Motion economy is fundamentally a function of the foreman's. It is true that the foreman may be guided better by a thorough understanding of the principles of motion economy and their application. For this purpose there are available literature, lectures, and courses fostered by management associations, educational institutions, and recognized authorities on the subject.

Begin with the Bigger Jobs

As always, starting is the hardest part of the task. Generally, it is better to start with the larger problem, then work toward the smaller items. This plan can be readily adapted to the motion study program by starting with the larger movements of materials and parts between departments. From this study the natural step is toward an analysis of the movement or flow of materials in a department, and finally to a study of the handling of the work on individual operations.

Flow of material between departments or in any particular department may be studied best by means of process charts. A great amount has been written about the purpose, application, and results obtained from a study of the facts pointed out by these charts. A discussion of them is therefore unnecessary at this time, and only the problems presented by the individual operations will be considered in this article.

How to approach the problem of

simplifying an operation through the application of motion study principles resolves itself into the answers to a few questions: The Gilbreths, Mogensen, and others have said the fundamental questions to answer are:

1. Can the operation be eliminated?
2. Can it be readily combined with another?
3. Can the sequence be changed?
4. Can it be simplified?

Analyzing From Every Angle

When we have viewed the first two of these questions from all possible angles it then becomes time to go to the next question. However, it is surprising to find the mortality rate extremely high. For example, the substitution of tinned stock may eliminate an expensive plating operation. A slight change in the design of a part may eliminate a burring, reaming, or milling operation. Changes in tolerances may reduce or eliminate expensive inspection operations. Some operations may be combined with the adjacent operation. When the operation has been analyzed from these angles and no solution suggested, the next step is a study of the possibilities of simplifying it.

A properly analyzed operation with motion study principles applied will not only produce the desired quantity, but will also produce a quality product with the most economical expenditure of energy. A false conception of motion study may frequently lead to a desire to speed the work up beyond the normal muscular abilities of an operator. The fatiguing factors increase proportionately at a much greater rate as abnormal muscular speeds are introduced. Since motion study has, as one of its fundamental objectives, the reduction of fatigue, it is desirable to have the movements performed as close to an effortless muscular rhythm as practicable.

In addition to the muscular rhythm there are other factors recognized as being likely to cause both the feeling of tiredness, or true fatigue, and mental fatigue which may coincide with it. Mental activity such as worry, disgust, fear, and the reactions of poor shop environments as well as physical activities may cause fatigue. The maintaining of a muscular tension, sitting and standing uncomfortably or for too long a period, are factors conducive to fatigue.

Operation consists of opening a small tubular box, received flat in bundles, folding over the bottom, inserting the flap. To eliminate the large amount of idle time indicated in the chart, boxes are now made up on two wooden spindles fastened to the bench. Spindles are dimensioned to give easy sliding fit and tapered so that in sliding on the spindle the box is opened and positioned for tucking in the flap. Holes were bored in the spindles and compressed air is used to eject boxes through a guide screen—ready for use on the next operation. From the *old* and *new* charts it is seen that it formerly took 14 movements of both hands to make 1 box. Now it takes 12 movements to make 2 boxes—a saving of more than 40 per cent in time per box. The photograph, enlarged from 16 mm. film, shows how the two hands work simultaneously

OLD WAY

Left Hand	*Right Hand*
1. Idle	Move to packed bundle
2. Idle	Pick up box
3. Idle	Return
4. Fold over end	Hold box
5. Tuck flap in top	Hold box
6. Idle	Transport to container for later use
7. Idle	Transport container to next operation

NEW WAY

Left Hand	*Right Hand*
1. Move to stack	Move to stack
2. Pick up flat box	Pick up flat box
3. Transport to spindle	Transport to spindle
4. Insert box on spindle	Insert box on spindle
5. Fold-over end	Fold over end
6. Tuck in top with thumb and finger	Tuck in top with thumb and finger

Ejecting box with foot pedal release

Motion study aims at eliminating or reducing these elements through the application of the following fundamental principles:

1. By the substitution of mechanical apparatus. Jigs, holding fixtures, drop delivery chutes, power-driven tools, not only eliminate the time but also the energy consumed in performing the work.

2. By arranging the parts properly in a semicircle in the work area, it is often possible to substitute a lower order muscle—in other words, to employ a lower arm, wrist, or even finger movement where before the shoulder and upper arms were used. This substitution not only reduces the amount of energy necessary to motivate the muscles but also greatly facilitates the ease of development of supports for the lower arm and wrists. With the lower arm and wrist supported a great reduction in muscle fatigue is effected.

3. By studying the movements used, unequal distribution of work between the arms or hands may be readily noted. One hand may be holding or completely idle while the other is worked to complete exhaustion in order to keep up the production pace. By shifting part of the work to the other hand a more equitable distribution of the work may be accomplished. The overworked, highly fatigued hand may be given more frequent rest periods; a smoother rhythm can be developed and production maintained or increased with a lot less fatigue.

To Illustrate

The photographs—taken in a midwestern plant—serve to illustrate these points. The *before* and *after* movements in the charts indicate how the work has been shifted to a mechanical means or equalized between the hands.

So much emphasis is placed on savings in time that other favorable influences of motion study—on safety, quality, orderliness, morale, for instance—are often overlooked. As they are all part of the foreman's responsibility, they point out further need for his having a working knowledge and taking an active part in the motion study program.

A Budget So Simple

Shop men understand it, which is no criticism of shop men, but rather an indictment of the usual budget

H. P. DUTTON
Associate Editor

THAT budget control may be geared in a practical way to everyday factory operation is proved by the experience of a large mid-western manufacturer. Every operating department in this factory works on a definite production budget that tells just how many units shall be completed each day, and at what expense they should be produced. Costs and financial control are not mysteries to the men in charge of plant operation. They have become practical everyday working tools.

When a new model is made up, its cost is estimated in a preliminary way by the works manager's department. Costs of materials are derived from the quantities shown in the bills of material, and labor costs are available from piece-price records of similar jobs. If the costs as thus worked out are higher, in the sales manager's judgment, than the market will stand for, designing engineers and production men get together and see what changes can be made to bring them into line.

Setting the Rates

When the model is satisfactory both from manufacturing and performance standpoints, it is approved by the general manager and turned over to the factory manager for production. Tools are made. Process and assembly lines are laid out. When all is ready, production is started and run for a week or so on daywork, to straighten out kinks and accustom the crew to the job.

When the rate setters are sure that the method and conditions of operation are right, group piece rates are set. These rates are checked with the classified records of previous similar jobs, so that there is not much chance of going wrong.

The manufacturing department, with the help of the priced bills of materials and suitable allowances for scrap, sets a standard cost which thereupon becomes the official basis for the pricing of inventories and measurement of results. These standard costs, which include labor, material, and factory burden, may be corrected to correspond with engineering changes, but ordinary variations are taken up in various accounts, which become a measure of departmental effectiveness.

Budgeting Direct Labor Costs

In setting these standard costs, the manufacturing department covers itself by making a quantity price—say $3.55 each for the first 10,000, $3.53 for the next 20,000, $2.92 for all subsequent continuous-run deliveries.

On this basis it is a simple matter to budget direct labor cost allowed a general foreman for a given production schedule. To this cost a percentage is added, based on experience in each department, for normal unavoidable direct labor not included in standard allowances — such items as repair, re-working, or change of parts, time allowances for training new operators, or cost of special jobs.

The sum of this standard labor cost and normal non-standard direct labor gives a total direct labor figure for each department.

Expenses in any department may be divided into two classes — those tending to increase proportionately with output, and those that have little or no relation to volume. Expenses that are fixed are included under the general headings of "supervision" and "miscellaneous fixed."

Those considered controllable by the department are grouped under the following headings for production departments: Controllable indirect labor (clerks, typists, material men, set-up men, salvage men, etc.); supplies; light, power, gas; scrap, materials; scrap, labor; inspection; repairs to equipment; repairs to tools; sweeping; oiling.

Under these two general classifications, with appropriate subdivisions for each department, service as well as operating, an estimate of the operating expense of every department is made every four weeks.

Fixed expenses are listed by totaling salaries of permanent employees and other non-varying charges. (Taxes, depreciation, and other non-operating charges, not under con-

BUDGET REPORT

PLANT OR DEPT. _____
DATE _____
PERIOD ENDING _____

DIRECT LABOR FOR PLANT — STANDARD LABOR (Included in Direct)
Actual for Day _____ — Actual for Day _____
Cumulative Actual _____ — Cumulative Actual _____

	BUDGET FOR DAY	ACTUAL FOR DAY	CUMULATIVE BUDGET	CUMULATIVE ACTUAL
CONTROLLABLE EXCESS				
SUPERVISION				
INDIRECT LABOR				
SUPPLIES				
MATERIAL SCRAP				
LABOR SCRAP				
SHEARING AND SLITTING				
EXPERIMENTAL				

Figure 1. General foremen soon found they could not afford to wait a month to find out whether they had spent all their allowance under any budget item. Hence this daily budget summary and comparison

trol of general foremen, are not included in operating budgets.)

Controllable expenses are stated as percentages of total direct labor. Percentages assignable to each element were arrived at originally by an analysis of records for the previous six months. For a time detailed studies of expense were made, so that the management knew, for instance, how many wiping rags were required to finish 100 units. Now that the management has a good idea of the nature of these indirect costs, these detailed studies are no longer felt to be necessary.

The various expense standards named above are summarized in comparative form, showing the allowance for each plant for each item, on a simple one-page expense budget for the whole plant. Copies go every four weeks (the factory operates on a 13-month calendar) to each general foreman, so that each knows what allowances the others are getting.

Simplicity the Keynote

This working budget has intentionally been kept simple. Simplicity means that all the work of making up the budgets for all departments is done in about four days' time each period by one man in the factory manager's department.

Simplicity also leaves greater responsibility in the hands of the general foreman, who usually welcomes it and resents being tied to the apron strings of a clerical department. The management bases its requirements on standards, which in turn are based on thorough and detailed studies. Having accurate and fair standards, the management allows the executive as free a hand as possible to meet the task in his own way. The general foreman has available the detailed figures compiled by the cost department if he wishes to get back to the source of any variation in his costs.

Thinking in the Ranks

To illustrate how the decentralized responsibility of the system encourages thinking in the ranks, one of the superintendents put it up to a foreman to stop excessive rejection on a certain assembly. The foreman worked out a plan by which a simple hektographed diagram of the assembly is furnished each inspector, who tallies on it the points at which defects are found.

As soon as these defects begin to run into money at any point, the inspector informs the supervisor, who can take steps to correct the difficulty. Usually the trouble is caught before it becomes serious enough to influence the percentage allowances, and this is done with practically no red tape or other entanglements.

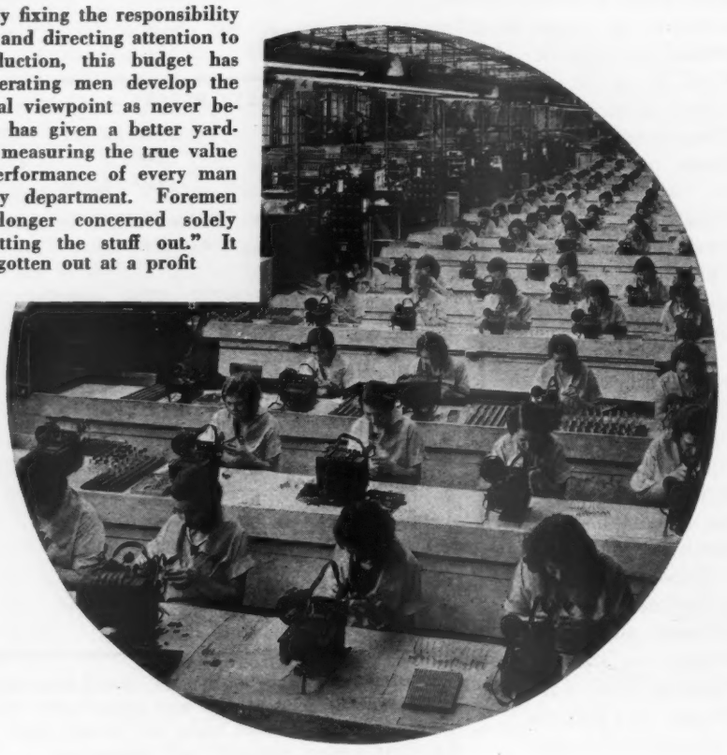
It very quickly became clear to the general foremen that they could not afford to wait a month to find out whether they had spent all their allowance under any budget item, and they began asking their clerks to make a record of department expenditures. In the interest of economy, the management consolidated these reports in the factory manager's department. One young woman posts daily to the department accounts, from a tape record furnished by the tabulating department, each charge to a department expense account. Daily, within two or three days after the event, she also furnishes each general foreman with the budget summary and comparison shown in Figure 1.

Responsibilities are Fixed

That, in brief, is the plan. As might be expected, it leads to a strict accounting for responsibility for charges. No foreman is going to accept responsibility for a charge for defective material, if he thinks the purchasing department failed to furnish the material specified, or if the specifications were at fault. If the management wants to give extra training to selected operators, as might be necessary in an expansion of force, it must be prepared to charge the expense to a suitable general expense account, unless it can convince the general foreman that it is his responsibility, or to his advantage, to accept the charge against his department.

Where men know in advance that their statements can and will be tested in the light of definite facts and standards, this plan of determining responsibilities does not produce many or serious differences of opinion.

Occasionally, to meet some shop situation, the accounting department may be asked to set up a new expense classification perhaps unnecessary from the accounting standpoint but vital to the equitable distribution of shop expense against the budget of the foreman responsible. The foremen's confidence that they are charged only with expense entirely within their control has largely been responsible for the success of the budget.



By clearly fixing the responsibility for costs and directing attention to their reduction, this budget has made operating men develop the managerial viewpoint as never before, and has given a better yardstick for measuring the true value of the performance of every man and every department. Foremen are no longer concerned solely with "getting the stuff out." It must be gotten out at a profit

We Must Make to Have

The best preventives of technological unemployment are more cost-cutting, labor-saving methods and machines

C. OLIVER WELLINGTON
Scovell, Wellington & Company
New York

THE GREATEST general prosperity this or any other nation ever enjoyed was due principally to the intelligent and persistent attacks that American industrialists had been making upon waste—especially their attacks upon waste of labor.

. . . a pleasant dream that the Government would hold a nation-sized umbrella over all American businesses no matter how inefficient they might be —but it was only a dream

At first most of those who strove for more efficient methods looked upon waste elimination solely as a tool with which to increase operating profits.

But it soon occurred to the more thoughtful leaders that the enormously increased production per man-hour not only demanded, but—which is much more important from a profit viewpoint—made possible, a greatly enlarged consumer market.

In short, industry accepted and profited by the comparatively new economic philosophy that holds we are now living in an economy of plenty—that not only can we produce enough so that all can live in near luxury, but it is the proper and possible aim of business to provide a standard of living that the communists claim can be secured only by complete destruction of the capitalistic system.

Of course this ultimate ideal has not yet been reached, but enough in the way of raising standards of living was achieved prior to the depression to prove the soundness of the theory.

It was done by giving part of the savings to the workers in higher earnings and part to the consumers —in reduced selling prices. Total purchasing power was thus brought up to a level never before reached. Markets increased to a point that no one had ever imagined possible, and business men enjoyed greater profits than they ever could have under the old philosophy of wider margins and smaller markets.

Wider Purchasing Power

Despite all this, certain highly uninformed pseudo-economists maintain that the technological improvements that made this general and widespread prosperity possible were chiefly responsible for the halt in our prosperity. They say the improvements in method that increased production per man-hour resulted in a large percentage of workers being thrown out of jobs permanently, and that it was the consequent loss of their purchasing power that forced factories to close.

I do not believe that technological unemployment had much to do with the depression. Certainly it was not a major cause. Nor do I believe that, if we follow the right procedure, we shall ever have permanent technological unemployment. Shorter hours may take up a little of the slack. New products will take up more. But the big reemployment will come, as it has in the past, from expanding purchasing power as a result of high wages and low prices based on lower costs. In short, the best preventive of technological unemployment is more technological improvements in the way of cost-cutting, labor-saving methods and machines.

All through American history, as

methods have been improved, additional workers have been needed. When the railroad was in its infancy there were many misgivings over what would happen to the poor stagecoach drivers and their families. But —the railroad made travel possible for the masses instead of merely for the rich.

I don't happen to know how many stagecoach drivers were displaced by the railroads, but I do know that in average years the railroads employ 1,500,000 people, and that does not include those who make the $1,500,000,000 worth of materials the railroads use each normal year.

A large force was maintained mainly to search for mislaid goods

More Employment

The story is always the same. Every method or device that reduces cost gives employment to additional workers in time—usually in a short time.

However, it cannot be denied that for the past four or five years we have been faced with a large volume of unemployment. But again I want to emphasize that it is only to a small extent technological. Much of the present unemployment is due to the natural hesitancy of employers to extend production because of uncertainty as to what the future holds, or because under present restrictions on hours and wages the manufacturer cannot, without offsetting improvements in production methods, make a profit.

In the early stages of NRA most business men accepted the code provisions for shorter hours and higher hourly pay without much worry as to what would happen to their costs, for they were led to believe that prices would be set high enough to assure profits. In effect the experimenters had apparently discarded the economic philosophy that had made us prosperous so long—namely, efficient utilization of labor, low costs, high wages, and comparatively low prices—and had taken the opposite position that waste is inherently virtuous. It was a pleasant dream that the Government would hold a nation-sized umbrella over all American businesses no matter how inefficient they might be—but it was only a dream.

It now appears that price restrictions in most industries will surely go, but that regulation of hours and wages may remain. It has become painfully apparent that neither NRA nor any other division of the Government is going to guarantee profits to anyone.

That is something each one will have to take care of for himself—and he will probably have to find a way to make profits in spite of the present or higher wage rates for current or shorter hours of work. There is only one way to do it—by eliminating all wastes, and especially by adopting production methods and machines that will increase the productivity of labor.

While in many instances reduction of costs may well be reflected in lower prices in order to increase consumption, it is to be remembered that there are some industries in which not even lowered prices will expand markets to any great extent. Members of such industries benefit directly from a wider profit margin, when they eliminate wastes.

No "Cracking Down"

Right now some business men seem to feel that if they do anything to reduce costs by more efficient methods they stand in danger of being "cracked down on." For example, I am told that producers of labor-saving machinery are constantly met with such an answer as this from prospective customers:

"Of course I'd like to install your machines, but I am sure we'd be in bad with Washington if we did."

Certainly, there have been no official orders from those in high places to the effect that waste is a virtue and that those who try to get costs down by means other than wage cuts will be punished.

Furthermore the Government's desire to see the capital goods industries recover quickly shows that there is no objection to labor-saving equipment on the part of the Administration.

Business men are perfectly free to adopt cost-cutting methods and machines—provided they do not try to cut costs by reducing wages or increasing hours of work.

As a matter of fact many concerns have been making determined attacks upon waste in whatever form it appears. I want to cite just a few examples. Notice that not all of them involved increasing the production of the factory worker. That type of betterment is possible in most plants, and probably for industry as a whole offers the biggest opportunity for large savings, but I want to drive home the point that there are many other places where worth-while savings can be made.

How to Cut Costs

Let us first consider what a concern in the metal-working industry was able to do in reducing labor costs, partly by improving methods and equipment, partly by changing plant layout so that there would be a smooth flow of materials. There

(Continued on advertising page 48)

How Trends Personnel Work?

From a survey of practices in 50 concerns, plant operating officials may gage the trend, also evaluate their own programs

D. S. PARKS
Personnel Director, University of Toledo
Toledo, Ohio

DESPITE the tendency of some plant managements during the past five years to toss overboard certain of their personnel activities as "things we can do without," a survey conducted by the class in personnel management at the University of Toledo indicates that industrial relations work came through the depression with relatively flying colors and is now due for a steady, healthy growth.

From the report—it is reproduced on this page—the individual concern may not only gage the trend of personnel management, but also evaluate its own program.

Questionnaires were mailed to 109 concerns, selected at random in 15 states and including such industries as automobile and steel manufacture, rubber, clothing, paper, soap, pens, drugs, glass, refrigerators, silk, canning, shoes, office equipment, food, and oil.

Experience of 50 Companies

Of the 109 concerns, 50 (a relatively high return for this type of investigation) replied in sufficient detail to indicate their practice and attitude toward a number of the more common features of personnel programs. Of these 50 companies, 6 employed 500 workers or less, 25 employed 5,000 or less, 21 employed 50,000 or less, and 4 employed over 50,000 workers each. Almost half a million workers are represented in the survey, whose results are summarized in the table.

When it became necessary to reduce personnel budgets or staffs, a majority of the 50 companies did so on the same scale as other departments. Four companies reduced budget or staff more than other departments; in eight companies, the reduction was less than in other departments. Two companies, employing 562 people, eliminated personnel work during the period, and 23 companies, employing over 321,000 people, did not curtail activities.

Personnel Practices of 50 Companies

Total Companies... 50 Total Employees...465,000	Practices before 1929		Added 1929-1934		Dropped 1929-1934		Will Add in Future		New Grand Total			
	Companies	Employees (thousands)	Companies	Employees (thousands)	Companies	Employees (thousands)	Companies	Employees (thousands)	Companies No.	Companies %	Employees (thousands)	% of Total Employees
Psychological tests	7	42.	0	...	1	.5	1	4.	7	14	45.	10
Trade tests	17	313.	0	...	1	.5	0	..	16	32	312.	67
Job analysis	29	411.	2	5.	3	3.	2	2.	30	60	415.	89
Personal introduction of employees to work	39	425.	1	5.	2	1.	0	..	38	76	429.	92
Follow-up methods in introduction of worker	30	394.	1	5.	3	2.	0	..	28	56	397.	85
Medical examination	38	431.	2	2.	0	..	0	..	40	80	433.	93
First-aid stations	41	396.	0	..	0	..	0	..	41	82	396.	85
Company hospital	33	408.	0	..	0	..	0	..	33	66	408.	88
Recreation room or rooms	32	349.	0	..	3	14.	0	..	29	58	335.	72
Athletic and recreational activities	34	385.	1	5.	2	2.	1	.6	34	68	387.	83
Lunchroom	41	441.	0	..	7	23.	0	..	34	68	418.	90
Employee relief	30	426.	4	13.	0	..	0	..	34	68	439.	94
Group life insurance	35	362.	3	57.	0	..	0	..	38	76	419.	90
Pensions	18	351.	2	8.	3	12.	1	.9	18	36	348.	75
Accident insurance (other than state)	29	345.	2	6.	1	3.	1	3.	31	62	351.	75
Personnel budgets	20	310.	2	10.	1	.5	1	.6	22	44	320.	69
Employee representation plans	18	325.	8	23.	1	4.	0	..	25	50	344.	74
Schools (training within company)	27	356.	2	4.	3	19.	1	4.	27	54	345.	74
Cooperative programs with universities	23	223.	1	2.	5	20.	0	..	19	38	205.	43
Company paper or magazine	31	383.	1	5.	12	73.	4	10.	24	48	325.	70

Where mechanization is possible, but wouldn't pay. The man would have to be there anyway. Molded loaves are placed in the pans at this point and go through the steam proofer

Where Layout Is Right

Production costs are likely right, too. Bakery or boltery, low-cost operation is bound to follow right plant layout

LEWIS K. URQUHART
Associate Editor

NO ONE would ever guess that the Williams Bakery was 10 years old. There are at least two good reasons why. First, those who planned it did a positively uncanny job of anticipating many of the refinements in plant layout that industry in general has been developing over the past decade, and which—again, in general—it has been so slow in putting to work. Second, the plant has never been allowed either to look or act its age.

Result, a bakery that, for economical handling and low-cost operation, will take a lot of beating.

Which is not to say that this Wilkes-Barre bakery has anything that other bakeries cannot have. Mixers, dividers, rounders, steam-proofers, traveling ovens, cooling conveyors, slicers, wrappers—are all standard equipment in the industry. It is not news to find them here. It would be news *not* to find them.

No, the fact is, other bakeries have a good many things this one doesn't have and wouldn't want—two of this and three of that, and a few score of bread racks for good measure. This plant gets along with one of everything. As for bread racks, try and find them.

It is, then, rather in the intelligent layout and use of standard equipment that this bakery shines. Nothing but an alarming unfamiliarity with things that are naval prevents our comparing it with a battle cruiser stripped for action. There is everywhere in the plant an appearance of leanness and fitness that bespeaks close attention to the details that make for economical plant operation.

Let's Go Through the Plant

A brief sketch of the process will serve to emphasize some of those details. Since this is not a bread-making but a layout story, the sketch will be sketchy in the places that pertain only to baking.

Flour is received on the ground floor, blended and bolted as needed, and carried via screw and bucket elevator to bins in the weigh-off room on the fourth floor, directly above the mixers, in the fermentation room just below.

Weighing off flour, water, and yeast is completely automatic. They are dropped to the floor below and mixed into a "sponge"—it's not "dough" until the other ingredients have been added.

After mixing, the sponge is flopped out into a trough—pronounce it trŏw in a bakery—and allowed to ferment or "rise." This takes 4½ to 5 hours, and leaves ample time to stop and talk about the way these troughs are handled in the fermentation room.

Here, as in many another bakery, there is an overhead rail conveyor system. This one is outstanding because it is simplicity itself. The trough rides down the room on a traveling transfer crane and is quickly and effortlessly switched into a vacant place. And after fermentation it is just as easily moved out of its stall, back down the center of the room, and off at right angles on another rail to a push-button elevator, which takes it back to the weigh-off room, where it is dumped into the mixer. Other ingredients—milk, sugar, salt, more flour, more water—

are then added and thoroughly mixed.

Meanwhile, the trough goes back to the fermentation room via the same elevator and overhead rail, and is waiting for the "dough"—it's dough from now on—when it comes out of the mixer.

The fermentation room, in passing, is cork lined and air-conditioned. It is kept at a constant temperature of 78 to 80 degrees with a relative humidity of 75 per cent. Quality of product depends, of course, on exact regulation of the fermentation process. Recording instruments tell the superintendent all he needs to know, make it unnecessary for him to rely on an operator's word or guess.

After mixing, the dough is turned out into a trough and allowed to sit for 18 to 20 minutes in the fermentation room before being dumped into a hopper above the dough divider on the second floor. This rest period gives the yeast a chance to start working again.

Dividing the Dough

The divider (see page 186) cuts the dough into small pieces, drops the pieces on a short belt conveyor which takes them to the rounder where they are made into balls and dropped into trays on a chain conveyor, which in turn takes them for a ride up around the ceiling. This is another rest period that gives fermentation process a chance to get started all over again.

Rest period over, the balls of dough arrive at the molder, which, though 15 mintues away by conveyor, is right next door to the rounder. Here the balls are rolled into thin sheets, then rolled up again, emerging on a belt conveyor which carries them a very few feet to the point where they are placed in the baking pans and conveyed through the steam-proofer.

Uniform Loaves

This is the first and only time the dough is touched by hand. It would be possible to transfer the molded loaves into the pans by some mechanical means. Actually there would be no saving. A man would be needed at this point in either case, and it is a matter of record that manual placing results in more uniform loaves of bread.

This steam-proofer is a room kept at 95 degrees and 80 per cent humidity. The air is continually renewed and washed by being drawn through a spray chamber. It takes 60 minutes for the pans of dough to go through the proofer.

As the pans leave, they are deposited on receiving fingers at the entrance to the oven. An automatic arm, synchronized with the proofing conveyor, pushes the pans in.

This is a good illustration of when it pays to mechanize. Here is something that can hardly go wrong. The investment was small. It replaces a man. On the other hand, when the pans leave the oven, the bread is knocked out by hand. It would be possible to mechanize this operation, too. But this would mean something rather more complicated since the pans would have to be picked up and turned over. The investment would be fairly heavy. The equipment would get out of order easily. Furthermore, bread pans come in sets of four or five bound together. Break a few every week and mechanical handling would soon cost more than it would save.

As it is, one man takes the pans as they slide out of the oven, turns out the loaves, which slide down to the cooling conveyor, and places the pans on the conveyor that takes them back through a cooling tunnel to a point where they are either greased again and used immediately, or are stored if they are not the right size for the kind of loaf that happens at the moment to be going into the steam-proofer.

From the cooling conveyor the loaves slide down to an oval-shaped sorting table on the first floor, which is in reality a moving conveyor whose wooden slats are so shaped and arranged that it can turn corner. From sorting, loaves go directly to the slicer—only enough is sold unsliced to complicate things a little—and at once without rehandling through the wrapping machine and out to a conveyor which takes them to the point where they are packed into fiber shipping trays.

Conveyorized Shipping

These trays are placed on a conveyor that runs the length of a narrow shipping room. This conveyor is made up of two endless chains separated by spacers that are in reality steel rolls left free to turn. Paralleling the conveyor is a series of bins, some 25 of them, each the width of a tray and about a dozen feet deep, with the other end opening directly onto the shipping platform. Each bin holds eight tiers of trays on simple angle irons, eight trays to a tier.

(Continued on advertising page 56)

Where mechanization *does* pay. As pans descend from the proofer they are deposited on receiving fingers at entrance to oven. An automatic arm synchronized with descending conveyor pushes them in

Those Job-Curve Ups and Downs

Pages out of Frigidaire's experience show what manufacturers in seasonal lines can do to level off employment

ARTHUR VAN VLISSINGEN, JR.
Special Correspondent, Chicago

EMPLOYMENT peaks and valleys are not desirable. Nobody has ever disputed this truism. But few people have ever done much about it, beyond the classic example of combining a coal and an ice business to make a year-round demand. A few firms, of course, give and guarantee level employment.

Some months ago General Motors Corporation announced a policy of leveling off employment. Orders to this effect went out to the operating divisions, and they have been attempting to carry out instructions. News stories about these efforts have been vague. Which is not to be wondered at, in view of the manifest difficulties of cutting off the peaks and dumping them as fill into the valleys of so inherently seasonal an industry, not to mention the impossibility of storing any great proportion of a year's production of finished cars.

Can Store Refrigerators

More specific among the General Motors news releases in this field were those from Frigidaire. Storing refrigerators is more feasible than warehousing automobiles.

Frigidaire executives won't talk. Their attitude can be summed up in a short paragraph:

"We have been at this for only a few months. We have indications, not final conclusions. It will be time enough to brag when we have more than a year's experience behind us. Meanwhile, we are not going to stick our necks out by talking out of turn."

So this article has been constructed from sources outside official channels. Its figures have been taken principally from official statements issued for publication. Its other facts have been gathered from individuals close enough to the situation to speak accurately if not officially. And it is offered here for the benefit it may bring to other manufacturers who are shaping their own plans to reduce the violence of fluctuations in their own factory employment.

When 1934 Frigidaires were going into the active selling season, the sales executives made a country-wide swing, holding regional meetings, well along in March. Note that date. It is important. The official opening of the national sales campaign was in March of 1934. Shortly afterward, corporation policies began shaping toward the level employment plan. In consequence, the entire annual calendar of this division was altered.

Jumped the Gun

While the sales campaign was well under way, the engineers plunged into their task of designing the 1935 product. Meetings were held with regional managers, with key dealers. Results of a survey of the preferences of 100,000 housewives were digested. With all this information at hand, the engineers presently developed the 1935 model.

By mid-autumn the plants had been tooled for production at an outlay of $1,600,000. By December they were running at the best speed attainable in the earlier weeks of a production schedule. By the end of the year, production had reached the point where public announcements were made of the leasing of large warehouse space scattered around the city of Dayton. Announcements were credited jointly to the four General Motors divisions in Dayton. But by far the greatest of these is Frigidaire, and likewise by far the bulkiest product of the lot is the electric refrigerator. Therefore it is a safe assumption that the storage space was 75 per cent for Frigidaire purposes.

This year the "traveling circus" of sales executives did not wait until March! It went out in January, thus officially launching the years' sales campaign two months earlier than ever before. The idea apparently met with little or no resistance among dealers, and the division consequently has enjoyed an earlier start on its active shipping season —not to mention the benefits of jumping the gun ahead of competition in the field.

Whether or not this leads to an abnormal proportion of the year's refrigerator business going to Frigidaire, certainly it is a long step toward leveling off the spring peak. Assume 60 per cent of the year's sales customarily concentrated in April, May, and June, with only 8 per cent in February and March—the figures will do for illustration. By starting earlier, this 68 per cent of production is shipped and sold rather evenly during the five months, February through June. That is an average of 14 per cent per month, as against an average of 20 per cent per month for the old three-months' peak period. Which is real leveling off!

What of the results in Frigidaire employment figures? These statistics are never available from official sources, but they can be closely approximated.

Long Time Between Peaks

In bygone years, it has been periodically published—presumably to spread the idea of the product's appeal, and thus further to increase sales—that "Last week employment at Frigidaire reached a new peak," and so on. The last recorded peak was upward of 12,000 men and women in Dayton. When the plant is running at the very bottom, it works about 6,000. It is a safe estimate that by last December there were above 9,000 people at work, that by mid-March, when this is written, this has not increased by more than 1,000.

In other words, it will be a long

while, under present policies, before anyone can again announce a new peak in Frigidaire employment. There may be, probably will be, more man-hours worked. But the pay for these man-hours will be distributed under the present procedure among a smaller number of people and spread far more evenly.

Today's peak of employment, in number of people, is approximately 20 per cent below former peaks—and in the first year of experimentation. Presumably forthcoming years will lead to an even more pronounced equalization of force from month to month.

What It Has Done for Dayton

The result to Dayton's industrial population has been important. Not alone in its effect on the people employed at Frigidaire. Of great importance is the effect on regularity of employment in the three other General Motors manufacturing divisions in Dayton. Delco Products makes motors for Frigidaire; Inland makes ice cube trays, gaskets, and other rubber parts; Moraine Products builds lubricated bearings which go into refrigerators.

To be sure, each of these plants has many other customers. But to the extent that Frigidaire commitments have called for deliveries more evenly over the months, these plants have found their seasonal peaks leveled. (Of course they have likewise been leveling off their own employment, independently of Frigidaire, in conformity with the same corporation policy.)

No doubt the leveling of the Frigidaire production schedule, calling as it does for more even monthly deliveries from suppliers, has had an equalizing effect on employment in dozens of communities where parts and supplies originate for its plants. But the Dayton situation emphasizes the effect, since these three major suppliers are situated right in the same town.

Some substantial benefits are accruing to Frigidaire through the workings of this program. In the first place, since the busy season has been lengthened by an early start, it is likely that the investment in production equipment has been decreased to an extent at least equaling the cost of renting warehouse space. No official information is available on this point. Again, suppliers are delivering parts and materials more satisfactorily and without the hectic bustle ordinarily experienced—which means less likelihood of waiting time or even temporary shutdowns due to interrupted supplies.

Proof that Frigidaire is making real progress in the General Motors campaign to level off employment may be found in this warehouse full of refrigerators. It is one of several storage spaces recently leased in and around Dayton

The More Work, The More Skill

More important is the increase in average skill of the working force under the level employment plan. In former years, people had to be employed for emergency peaks of such brief duration that many of them never attained an ordinary proficiency by the time they were laid off. For that matter, there was no great incentive for the distinctly temporary employee to develop skill, since he could not cash in on it to any considerable extent. As this is written, just when the peak of production was reached in previous years, all but a negligible proportion of the factory force has been continuously employed for at least four months, with another month's steady work in prospect for even the marginal fringe. The effect in direct labor costs may well be imagined.

These Trends Are Disclosed

As has already been stipulated, no definite conclusions can be drawn from this Frigidaire experience of only a few months. There are, however, some trends disclosed which may be worth consideration by other manufacturers who are thinking along the same general lines:

1. Even in a highly seasonal line, advance planning and advancement of the active sales season may stretch out the delivery period by a proportion substantial enough to cut several per cent off the old peak months.

2. Except for a product too bulky to warehouse in proportion to its value, the cost of storing may be far below the savings attained by the pre-season production schedule. Frigidaire and the other Dayton units of General Motors obtained their additional space through leasing disused plants, presumably at rentals below the cost of regular warehouse facilities.

3. Limiting factor for many companies would be the funds tied up in temporarily dead inventory. This can be circumvented in many instances by storing in public warehouses, or by turning over storage space to a recognized field warehousing organization so that bank loans can be obtained against the warehouseman's receipts.

4. Leveling production reduces investment in plant equipment because peak production need never be so high.

5. Increased average skill of employees through longer terms of employment is an important consideration in many lines.

6. Effect on wholesome economics is not limited to local community, but extends to every community from which materials, parts, and supplies are drawn.

Now to Get the Money

1935 Is Building Maintenance Year, we said last month. Where, you inquired, can we get the money? Have you, we reply, tried the RFC?

F. A. SMITH
President, Miller, Franklin & Company
New York

IT IS NOT generally known that the Act of Congress of January 31, 1934, has given wider discretion to the Reconstruction Finance Corporation to determine the purpose for which the proceeds of such loans may be applied. Among those purposes is one quite favorably regarded by Washington authorities—namely, the rehabilitation, modernization, overhauling, remodeling — call it what you will—of industrial plants. Those charged with the task of aiding industry toward recovery consider it essential that plant deterioration shall be immediately arrested and corrected by adequate repairs and renewals.

Many applications for loans, for this purpose among others, have been received by the Corporation from the more enterprising proprietors of manufacturing establishments. Such applications have been promptly granted in a gratifyingly large percentage of cases.

The number would most likely be greater still, if more manufacturers knew how favorable are the terms of such loans and how simple is the process of negotiating them.

To Put Men to Work

The primary interest of an RFC loan to industry is to maintain and increase employment. The original act limited such loans, somewhat vaguely, to the payment of labor and the purchase of material incident to the operation of a business.

Subsequent rulings and supplementary legislation have increased the scope to include loans (a) for plant rehabilitation, (b) for the purchase of additional machinery, (c) for new enterprises and expansion of existing businesses, (d) to finance industrial construction, (e) to contractors, and (f) to pay existing indebtedness and taxes.

Individual loans total as much as $500,000. If made for capital expenditures, they may be continued in force for ten years—until January 31, 1945—under a suitable amortization plan, which will not impair the borrower's working capital. The interest rate is at present six per cent but is subject to reduction at the discretion of the RFC much as money rates are regulated by the Federal reserve. Short-term credits must be repaid in five years or less.

Ten Years to Pay

Plant rehabilitation is, as a general thing, a capital expenditure, and a loan for that purpose is subject to the long-term provision. While there is and can be no definite ruling on renewals beyond the 10-year period, the present intent is that such renewals will be granted if circumstances warrant.

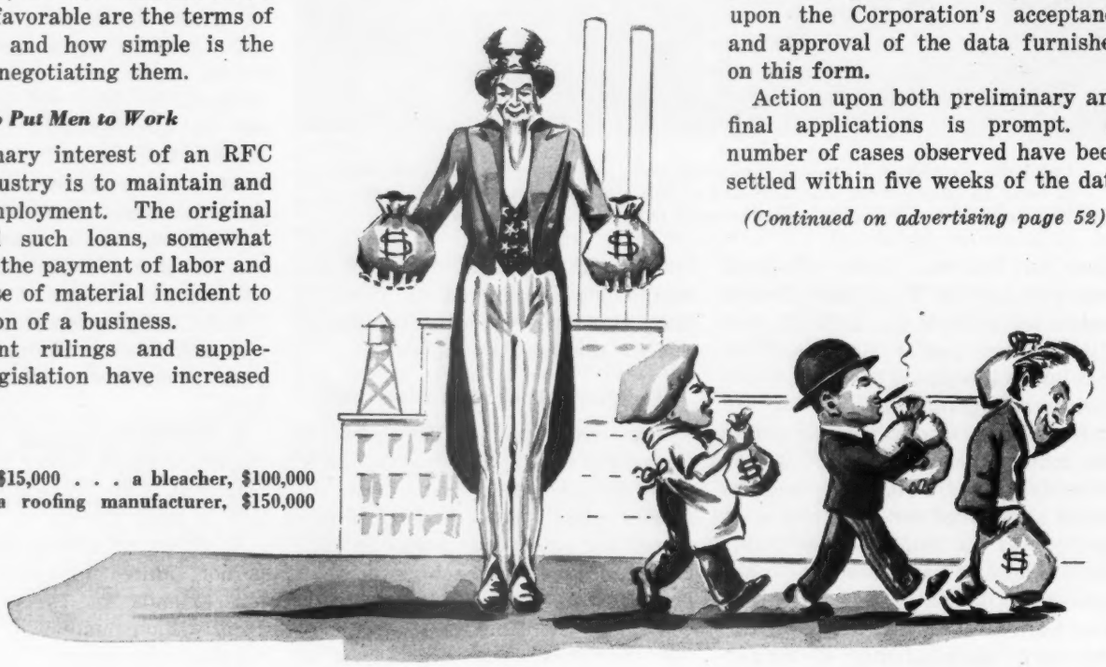
How to Apply for a Loan

The procedure of applying for a loan is this: A short form of application, Form L 236, is first filled out. It states in very general terms the purposes to which the proceeds of the loan are to be devoted and gives data concerning the financial status and previous record of the applicant.

This is filed with the district loan agency. There are 32 agencies in the principal cities of the United States. Their locations are set forth in Circular No. 13 (Revised) of the Corporation. If the data presented are acceptable, the applicant is required to prepare and submit detailed information and supporting data on the long form of final application, Form L 173, as revised to date. The grant of the loan depends upon the Corporation's acceptance and approval of the data furnished on this form.

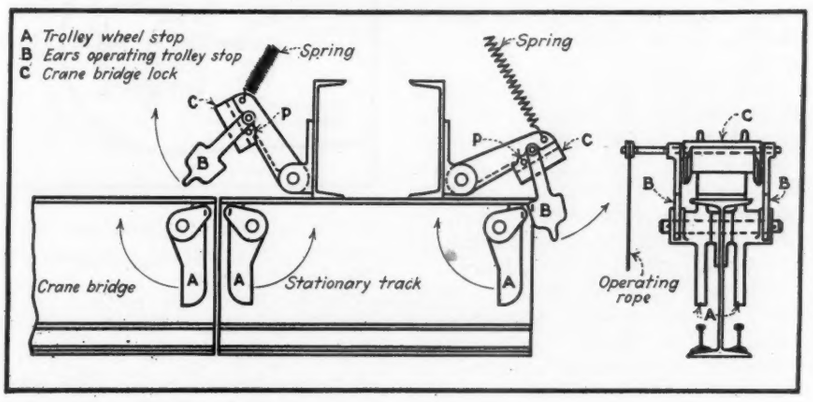
Action upon both preliminary and final applications is prompt. A number of cases observed have been settled within five weeks of the date

(Continued on advertising page 52)



A baker got $15,000 . . . a bleacher, $100,000 . . . and a roofing manufacturer, $150,000

OPERATING SHORTS



Safety Stop and Interlock for Transfer Crane

R. A. PERRETT, *Oak Park, Ill.*

The transfer crane in our plant was always a source of danger and trouble because of the type of crane bridge lock and trolley stops used. If they were not watched and operated carefully, the hoist was likely to run off the end of the crane bridge and go crashing to the floor. The damage, even if the hoist missed the operator, was considerable.

We attempted to buy a better type of interlock, but could find none on the market that would fit our present crane or the stationary transfer points. We therefore designed the one shown here. The principle of this device can be used on most transfer cranes. It is simple, inexpensive, foolproof, and safe.

The pin *P* holds the ears *B* in the proper position to engage the stops *A* when the lock *C* is lowered. The ears are hung independently of each other and will swing freely in the directions indicated by the arrows. If the lock is pulled down when the crane bridge is not in line with the transfer point, the ears swing out of position as they hit the stops which remain set. The stops on the stationary track and on the crane bridge are dependent upon each other for their operation. If these stops are not opposite each other, they cannot be raised. They cannot be opposite each other unless the crane bridge and the stationary track are properly lined up. When they are raised, the lock is in place holding both sections firmly in line. Since there are no ropes connected to the stops, they can be raised only by pulling the lock down.

The device is fool-proof, because it makes it impossible for the hoist to run off the end of either the crane track or the stationary transfer track. The stops cannot be raised unless the crane is properly aligned with the transfer point. Since the stops have no ropes attached to them, they cannot possibly be raised when the crane is at any location other than the transfer point.

It is simple, because there are few parts. All that move involve the simple hinge principle. There is only one operating rope. Its operation locks the crane with the transfer point and at the same time raises the trolley stops. The rope is located at the transfer point where it is needed; hence it is not in the way when the crane is being used at some remote part of the shop.

Mr. Perrett's contribution has been awarded the $10 payment offered by the editors for the best Operating Short submitted during the past month.

•

One Way to Keep Plant Orderly

CHARLES S. STEVENSON
General Manager, Hall Brothers, Inc. Kansas City, Mo.

With the thought in mind that a clean, orderly factory will have a decided effect on the quality of the product being made, we have a monthly inspection of our plant by a group of three persons appointed by the manager. The personnel of the committee is different each month and drawn from the employees of all departments.

It was the practice of this committee to turn in one hundred fifty to two hundred notes each month on minor conditions, mostly indicating disorderly departments. A quantity of work fell to the manager to issue instructions covering all these notes.

The idea has always been effective with the department heads, but until recently has not had any great appeal for the workers, as they were generally not aware of what the committee was reporting until the report had been posted late the next day. Under this arrangement, the department head probably did a little toward correcting the condition, but there was no concerted action.

A new idea, recently installed, has eliminated the work required of the manager, has speeded up the committee in its inspection, and has had a decided effect on the employees, as well as on the department heads. The committee was supplied with one hundred signs 7 inches wide and 22 inches long, scored in the center with the words "Cleaning Up Needed Here — Inspection Committee" printed in large red letters.

When the committee is making a tour and comes upon a condition that requires attention, it leaves one of these signs there. This indicator of disorderliness stands out so prominently that everyone in the depart-

ment, and other departments as well, can see it.

The department heads are told they have 24 hours in which to remove the signs, but in most cases all that is needed is an hour or two. The inspection committee keeps a record of the locations where the signs were placed, and as the cleaning jobs are completed the various department heads turn the signs back to the committee.

Results of this innovation have been a rapid cleaning of the departments, and an increased interest on the part of the employees in the work of the inspection committee.

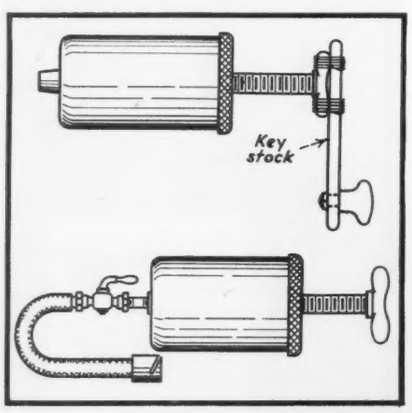
•

Two Ways to Improve Grease Gun Operation

OLIVER MANN, *Salem, Mass.*

The following two adaptions to regular grease guns can be easily made and will save time and energy on a disagreeable job.

One end of a 6-in. piece of key stock may be fastened to the handle of one type of hand gun and a knob fastened to the other end of the strip. The resulting handle for the grease gun has considerable leverage and adds a crank action that is easier for the operator than the normal twist action of the regular



handle. This attachment speeds operation of the gun considerably.

A $\frac{1}{8}$- or $\frac{1}{4}$-in. shutoff is inserted between a regular grease gun and its flexible hose. Without this attachment one must turn back the gun to relieve the pressure before the gun can be removed from any fitting. With this gadget, the hose is connected to the fitting, the shutoff opened, and sufficient grease squeezed into the fitting. Then the shutoff is closed and the hose disconnected without reversing gun or losing grease from the end of the hose. In addition, air pockets are eliminated.

Easy Way to Put Tight Belt on Pulley

M. M. GOOCH
Atlantic Highlands, N. J.

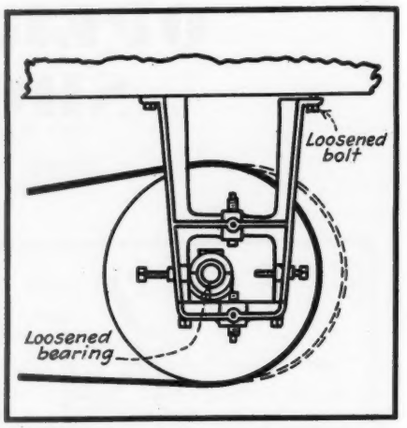
In your January number, under "Operating Shorts," the method of putting tight belts on pulleys proposed by H. Moore is not good practice, because one edge of the belt is likely to become stretched during the process.

The correct way is to hold and guide the belt so that it will run onto both pulleys simultaneously. There will then be no uneven stretch. Many an expensive new belt has been ruined before it has been used, by forcing it onto the pulleys in the manner advocated by Mr. Moore.

Where conditions allow, a good kink for putting tight belts onto the pulleys is to loosen the adjusting screws on the hangers as shown in the sketch. This permits the shaft to move over a considerable distance, temporarily shortening the distance between shaft centers and making it possible to put the belt on easily.

To provide even more play, one of the hanger bolts may be loosened to allow the hanger to swing inward. Where patented overhead beams are employed, it is sometimes possible to slide the entire hanger forward without touching the adjusting screws.

When the bearing adjusting screw is loosened the screws on the opposite side and on top should not be moved. This precaution helps in returning the bearing to its original position after the belt has been slipped on. If the hanger is moved, its position



should always be marked before moving, or a tedious realigning job will be necessary.

To be sure, this method is not always practical where there are belts running in both directions, as on a common line shaft. But where it can be employed, it is well worth while.

•

Hardfacing the edge of a feed cam on an automatic screw machine cost one quarter the price of the cam and extended its life from 12 weeks to one year.

•

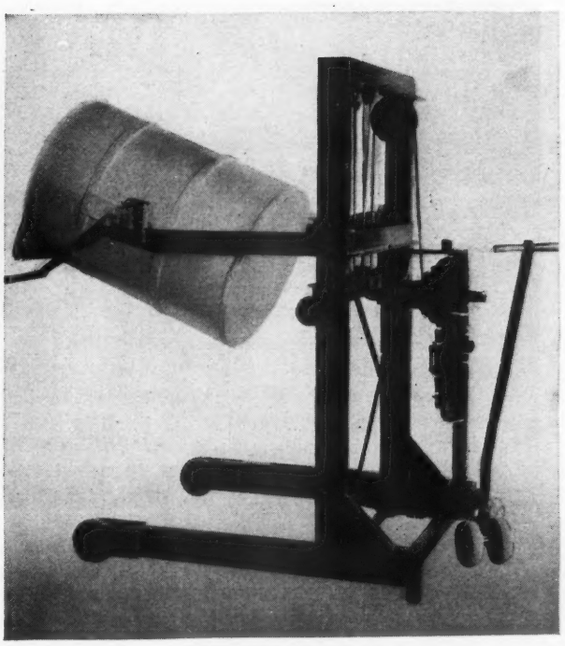
Tubing Cut Accurately to Length

Z. E. SARGISSON, *Akron, Ohio*

During the progress of certain soft tubular material through one of our departments, it is necessary that it be cut into short pieces which are multiples of quarter inches.

As shorter hours give more leisure to be used or wasted, management increases in appreciation of the value of hobbies for employees and the hobby show becomes more frequent a means of stimulating interest. This exhibit of hobbies by Globe-Wernicke employees contained hundreds of exhibits ranging from embroidery and wood carving through models, baking, and cabinet work to curios and a variety of collections; occupied nearly 20,000 square feet of floor space. Company products were also displayed

Formerly, it was sufficient to mark the lengths upon the tubing and then cut it with a handknife against a flat surface. Now it is required that the pieces be held more closely to the lengths specified, and that the plane of the cut ends be perpendicular to the axis of the tube.



To meet these more rigid requirements a set of wooden mandrels was made. These mandrels just fit inside the tubing, and one end of each mandrel is flared slightly for a length of three inches. By forcing one end of the tubing upon this flared section, the entire piece is restrained from turning upon the mandrel.

The mandrel with its tube is then mounted in an old pattern lathe. The toolpost of this lathe carries a horizontal bar upon the upper surface of which are notches or slots ¼ inch apart. This bar is set parallel with and close to the mounted tube and mandrel. With it as a steady-rest, a razor-edged, pointed knife is held in a notch and slowly forced horizontally through the wall of the spinning tube. As soon as the wall of the tubing is cut through, the operator withdraws his knife, counts off the required number of notches, reinserts his knife, and repeats the cycle of operations.

As a result of this device, we now secure tubular material of proper lengths and square cut faces. Although the number of operations has not been reduced, this new cutting method works so well that even with the greater accuracy required production has been increased.

•

Stacker Adapted for Dumping Containers

FRANCIS A. WESTBROOK
Consulting Engineer
Center Conway, N. H.

Adaption of a standard stacker to use as a dumping device was a trick hit upon by the Orford Soap Company of Manchester, Conn. The platform of the stacker was replaced by two arms at whose extremities were two sockets. These sockets were designed to fit the trunnions on metal containers in which were held materials used in the manufacture of soap. The device is operated by lowering the arms to a point where the trunnions can be grasped by the socket. The container is then raised and transported to the location where it is to be dumped. A ratchet and handle help finish the job.

•

Window coverings and daylight fixtures installed at the Panelyte Corp., Trenton, N. J., make possible detection of scratches on shiny plastics.

•

Marking Motors for Identification

J. H. SAUVE, *Temiscaming, Canada*

In the March issue Mr. S. H. Coleman mentions a way of marking motors.

The system we have is to stamp the mill number with 1-in. figure punches, always close to the name plate. The number is also stenciled with paint on the front end shield. This is for quick identification.

The idea of the punched figure is in case the motor is painted on the job and the stenciled number not put on again. Also sometimes the motor windings are burned out in a fire which destroys any painted mark.

The punched figures, being always near the name plate, are easily found. On very small motors we use smaller punches.

Accurate Adjustment for Ripsaw Fence

JOHN E. HYLER, *Peoria, Ill.*

Hand-feed ripsaws usually are equipped with an adjustable fence as shown in Figure 1. A fence of this type is easy to change but difficult, sometimes impossible, to set with extreme accuracy, although in many cases a high degree of accuracy is required.

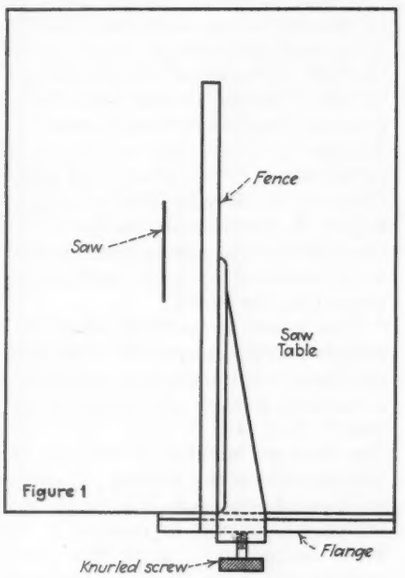


Figure 1

In Figure 2 is shown an improved saw fence that, while adjustable with all the speed of the conventional type when rough work is being done, incorporates a fine adjustment for extremely close setting. The wood portion of the fence is replaced by a special fence made of two tapered

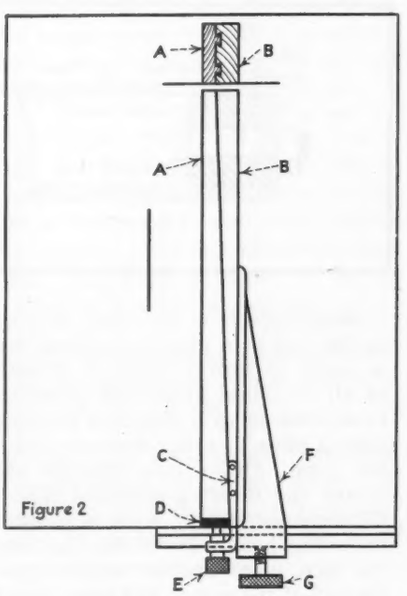


Figure 2

pieces, *A* and *B*, dovetailed together longitudinally, as shown in the sectional view, so that their outer edges are parallel. On the top of member *B* is mounted, with wood screws, a forged bracket, *C*, one end of which is bent at 90 degrees with the line marking the division between members *A* and *B*.

A hole is bored into the front end of member *A* to allow free working of a small adjustment screw. Over the hole is fastened a metal plate *D*. A hole is tapped in this plate for the knurled-head adjustment screw, *E*. Member *B* is screwed solidly to the metal fence *F*. Bracket *C* is solidly fastened to *B* and the adjustment screw, *E*, remains in the same position relative to the bracket because it is retained by two small collars pinned to the screw.

The effect of turning screw *E* is simply to slide *A* upon *B*. The travel of these two numbers is confined to a straight line by the dovetails with which they are joined. Obviously, the distance between *A* and the saw will be altered by sliding *A* upon *B* in this manner, but in a small ratio which will permit of making a very close adjustment, after the rough setting has been made in the usual manner.

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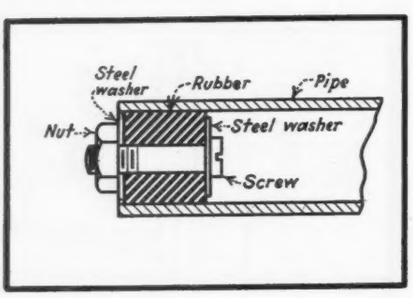
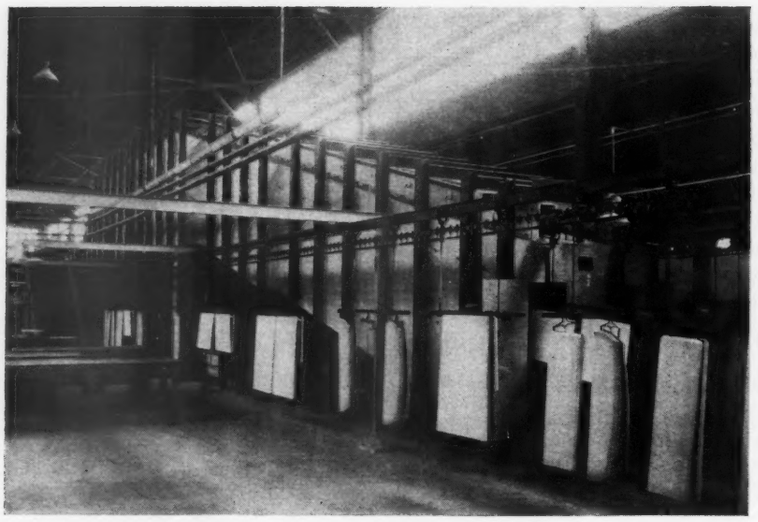
Emergency Plug for Round Holes

J. A. HONEGGER, *New York*



Sometimes it is necessary to plug up the end of a pipe or a round hole in order to prevent drip or leakage of air or liquid under low pressure. In an emergency a plug may be made from a piece of soft rubber or a rubber cork. Cut a hole through the center and insert a standard cap or fillister-head screw with a washer under the head. Force the plug into the hole, place another washer over the end of the screw, and then thread on a nut.

When the nut is taken up the rubber plug is expanded and forced tightly against the wall of the hole.



Furnace Maintenance Cost 1/5 of 1 Per Cent

SOURCE, *General Electric Company Schenectady, N. Y.*

Five years of carefully kept records show a yearly maintenance cost of less than $\frac{1}{5}$ of 1 per cent of the purchase price on a continuous enameling furnace installed at the Cleveland plant of the Enamel Products Company.

The equipment, a 600-kw., 230-volt, 3-phase electric furnace 95 feet long and consisting of a preheating chamber and an elevated heat-sealed firing chamber, was laid out for 2,400 square feet of work an hour. Since installation, however, it has averaged 4,000 square feet an hour or about 600 pounds per hour during a production day of 20 hours.

•

Huge Mill Housing Successfully Welded

SOURCE, *Metal & Thermit Corp. New York*

One of the largest Thermit repairs in many years was completed recently at a Mid-Western steel mill. The broken part was a housing of a 160-in. plate mill. The casting, minus all appurtenances, weighed 164,000 lb., stood 21 ft. 8½ in. high, and was 14 ft. 9 in. wide at the base and 10 ft. wide at the top.

The original fracture, which caused the housing to be removed from service, occurred in the lower portion and ran from an inside corner diagonally downward through a Tee-shaped section, one leg of which was 38 in. x 12 in., and the other leg 30 in. x 26 in. In preparing this fracture for welding, another crack was discovered above the first, running through a section shaped roughly like an I-beam.

Four tons of Thermit were required to make the two welds. The entire job, from the waxing of the first fracture to the pouring of the second weld, was completed in exactly one week. Since the cost of the two welds was only a fraction of the cost of a new housing, a considerable saving was effected.

•

Portable Fan Cuts Hardening Time

SOURCE, *Vogt's Ice Cream, Inc. New York*

A portable fan that circulates the air around containers of ice cream in the hardening room has cut the hardening time 10 per cent. It has also improved the quality of the cream, inasmuch as faster hardening reduces the size of the ice crystals.

The reduction in hardening time gives increased production capacity, valuable during peak operation in summer months.

SPECIAL NOTICE

$10 will be paid for the best Operating Short submitted during the month of May. The Editors are the judges. Other Shorts accepted will be paid for at attractive space rates.

You Want to Know

. . . and the editors will gladly tell you . . . more about the things mentioned on this page

• TELLS INSTANTLY which fuse is dead—a tiny neon lamp that draws no current until fuse has blown. No testing necessary.

• INVENTORY control methods. Copy of an important report, illustrated with forms, is yours for the asking.

• LUMINESCENT paint, newly offered, contains no radio-active matter, is neither inflammable nor toxic, can be easily applied to cloth, glass, metal, paper, wood, rubber.

• SHOULD sales headquarters be located at the factory or in a central office district? If this question comes up, the *pros* and *cons* are all contained in a report that's just off the press. It's free.

• TO CUT hard materials in tight places where blunt ends of hacksaw frames cannot get in, a new keyhole saw with pistol grip and thumb rest is recommended.

• PRESSURE-TYPE fire extinguisher requires no hand pumping, delivers fan-shaped or solid stream, weighs 16½ pounds fully charged.

• FREE, a digest of studies made on America's capacity to produce and to consume.

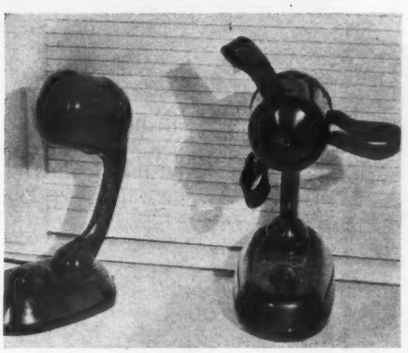
• STAINLESS paint is said to resist stains ordinarily caused by oxidizing of copper screens, iron screws, metal fittings.

• STEEL-TIED brick wall construction uses standard-sized grooved bricks with steel reinforcing rods, resists earthquakes.

• NUMBER 1, Volume I, of a package machinery manufacturer's house organ is on our desk. You can get on his mailing list if you like.

• HANDBOOK of industrial fabrics puts into convenient form the necessary data for engineers, purchasing agents, designers. May we tell you how to get a free copy of this $2 reference book?

• PORTABLE vulcanizer permits splicing of cord transmission belts while in place.



Safe, silent, effective to a distance of 10 feet, are some of the claims made for this fan whose "blades" are loops of silk ribbon. The fan at the left of the photograph is in motion

• THERE'S a new booklet describing most advanced theory of rust development, why it spreads, how it can be stopped.

• TANNIC acid jelly, just in case someone in the plant gets a second or third degree burn, is a good thing to have on the medicine shelf.

• LIGHTING fixtures are now to be had in molded urea plastic. In colors.

• 30-HOUR WEEK—arguments for it, the economic factors involved, what business paper editors think of it. New booklet.

• HISTORY of the lathe—all the way from the original tree lathe of 500 A.D.—pictured in a movie film you can borrow.

• THERMO-HYDROMETER enables one to check specific gravity of insulating varnish and make allowances for temperature variations.

• FIGGERING machine, new, retails for only $45, is lighter, costs less to make, because the case is molded.

• AMPOULES—in case they enter your scheme of things—are packaged by one manufacturer in a plastic box with a rack molded right into it.

• REPORT, just out, traces changes that have occurred from 1914 to 1933 in the distribution of manufacturers' receipts among the various items of costs and profits.

• BRITISH firm has developed an electro-plating process that eliminates mechanical polishing.

• FROM the stables of a manufacturer of handling equipment, the "Midget Shop Mule," said to be the smallest, most compact gas tractor on the market.

• SPECIALTY paper bags with a strip of transparent film running across one face let the buyer see what's inside—at low cost.

• SAFETY GLASS, newly announced, uses new type of adhesive, has high degree of flexibility, does not develop discolored blotches. Cuts easily, requires no sealing.

• NO long unwieldy cords with the trolley-square-duct system of providing electric current for portable tools.

• RUBBER that can be applied like paint is in the offing. Two kinds. One forms a temporary protective coating, can be stripped off when no longer required. Other is permanent, turns into live rubber or vulcanizes at normal temperatures.

• BAKING POWDER feller has a can that has a heavy paper inner-seal that keeps powder from spilling when first opened—and when part of the seal is cut away along a dotted line, the edge provides a handy means of leveling a spoonful.

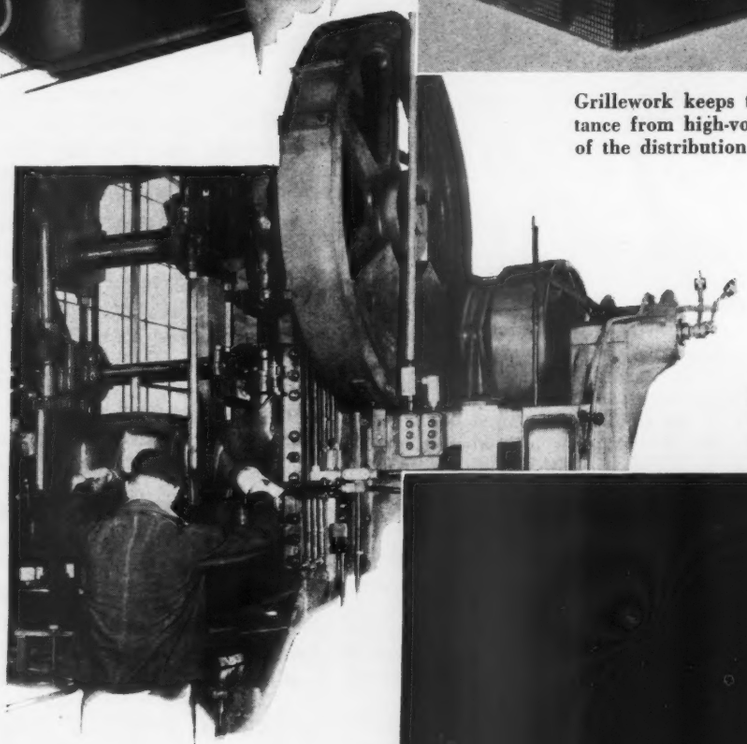
• ALL about how to handle customers' complaints—a report you may have for the asking.

• MANUAL on foreman training, intended both for group leaders and members of conference groups, outlines 38 conferences on major problems in foremanship.

• SPLASH-PROOF goggles, effectively ventilated, protect workers' eyes from dangerous liquids and flying particles.

Fingers must be safely out of the way when the knife of this paper cutter descends

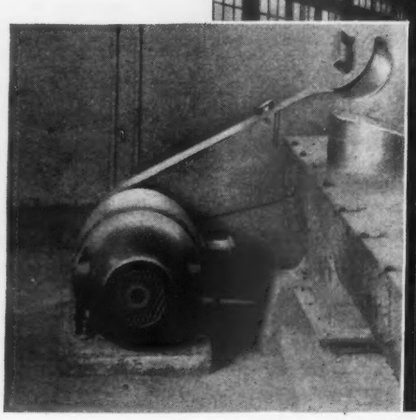
Grillework keeps the inquisitive at a safe distance from high-voltage equipment at the back of the distribution board in a cement mill



Hands up on the pushbuttons tell their own story of safety in the operation of this forming press

Properly located floodlights can make any industrial plant yard a perfectly safe place for men to work in at night

The mill room in a brewery is a good place to use a totally inclosed, fan-cooled motor. This one drives the grain conveyor. The control, too, is of dust-tight construction



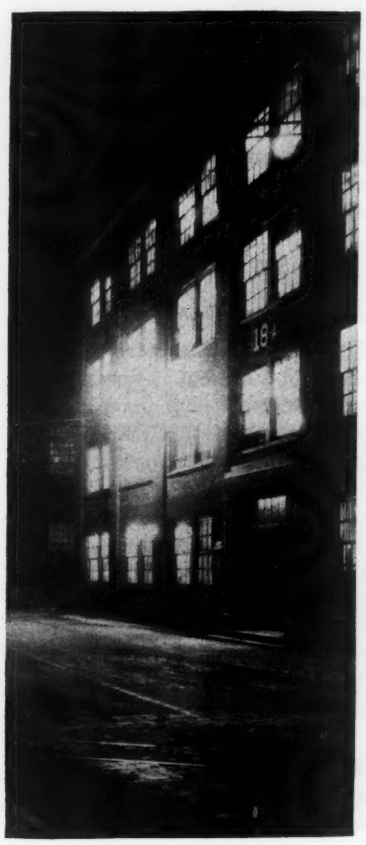
How Safe Are Your Machines?

Good light and proper safeguards are so much cheaper than accidents that it costs more to do without them

H. M. FRENCH
Industrial Engineering Department
General Electric Company
Schenectady, N. Y.

OPERATION of industrial machinery is attended with a certain amount of personal hazard. For many years little thought was given to the subject of safety; eventually, however, the terrific toll of life and limb that machines were constantly taking came to be recognized.

The electrical industry early recognized its part in this problem and has devoted an ever-increasing amount of attention to the protection of men's bodies and lives. Naturally, one of the greatest contributions that electrical manufacturers have made to industry in the interest of safety has been adequate and proper lighting and the lighting education that has gone with it. Artificial illumination is indispensable in plant operation, although the benefits resulting from proper lighting are not always fully recognized. Greater accuracy of workmanship, increased production, and a decided reduction in accidents, usually with an accompanying reduction in insurance rates, result from adequate lighting.



It has taken much effort to prove to industry that "adequate" and "proper" are not synonymous in connection with illumination. Lights may be so located that they provide adequate illumination, but if they cause glare they can be worse than no lights at all.

If lights are not used all the time, they should be turned on and off automatically, since workmen often fail to turn them on when needed, with the result that many accidents occur in the twilight zone near the end of the day. A very simple method of arranging for automatic operation of lights involves the use of a photoelectric relay. It will turn the lights on whenever needed, and turn them off when the general level of natural illumination reaches a safe point.

Floodlights in Yards

Night work in railroad and industrial plant yards is facilitated, and the likelihood of accidents or fatalities greatly decreased by proper illumination. For such work floodlights of one kind or another are required. Their use is so inexpensive in comparison with the increased safety afforded that they are a distinct economy.

Machines such as punch presses and guillotine paper cutters have been the cause of many injuries. Every worker knows what will happen if his hands get in the way of a descending punch or knife; nevertheless many are injured in this manner every year. There was need for some arrangement that would make it absolutely impossible for a man to get his hands caught.

The safeguard supplied by the electrical manufacturers is a control system with two or more pushbuttons in series, two for a one-man and four for a two-man press. All the pushbuttons must be depressed before the machine can be operated, and they are so located that one hand must be used for each one.

Providing for Quick Stops

Getting the hands caught in the rolls is a hazard that exists around open rolls and calenders in rubber mills. To minimize the danger of injury to operators, the driving equipment is designed so that the control functions in an extremely short time, and braking is as effective as possible. An emergency switch connected to the trip mechanism is wired in series with the forward-reverse line contactor of the solenoid brake. This switch is normally closed, but when the trip bar is moved either up or down the switch opens, the line contactor drops out, and the solenoid brake on the motor is tripped and set by a spring. The time normally required for the control to function does not exceed 2 seconds.

Motors used on these drives are all arranged for dynamic braking; this provides a quick stop and prevents operation in the reverse direction, which might be almost as dangerous as operation in the forward direction. With dynamic braking, the number of revolutions of the motor after the emergency switch is tripped varies between 1 and 2 per cent of the revolutions per minute. A 500-hp., 94.8-r.p.m. synchronous motor can be brought to a stop in 1.57 revolutions. As nor-

mally geared this is but a small fraction of a revolution of the rubber roll.

Most modern printing press control is equipped with safety signal systems to prevent operators from being injured by unexpected starting of the press. Newspaper presses are equipped with from five to fourteen pushbutton stations having a Safe button and a Run button. If an operator wishes to work on the press, he presses the Safe button at his station. This renders the press inoperative from all other stations.

A system of lights and/or a gong system gives further protection. When all Run buttons are pressed, the lamps are lighted and the gong is rung. A definite time delay provides that a certain period, say 3 to 5 seconds, must elapse before the press can be started. This gives operators time to get out of the way.

A development that is important in the matter of safety to personnel and equipment is explosion-proof motor and control equipment for use in the presence of explosive gases. This equipment is characterized by high strength of inclosing parts, long, close fits between joints, and other safety features, and is designed to prevent sparking or any flame or heat resulting from an explosion inside the motor from contacting the surrounding atmosphere in sufficient intensity to ignite it. It is therefore possible to locate the equipment wherever required in the hazardous area, rather than run a shaft through firewalls or risk using an open motor in a gas-laden atmosphere.

Explosive Gas and Dust

Equipment is also available for use in an atmosphere of explosive dust. It is likewise designed with special attention to fits and clearances of the various inclosing parts, since dust-tightness is essential.

Nearly all motor controllers are equipped with devices that disconnect the motor from the line on the occurrence of undervoltage or overload. Formerly, these devices simply disconnected the motor during the abnormal period and reconnected it to the line when the danger was past. It was found, however, that in many instances workmen were injured by the motor suddenly starting up while they were investigating to determine the reason for its stopping.

Safe Starting of Motors

Pushbutton-controlled magnetic switches are now arranged so that when a motor is disconnected from the line it will not restart until the start-button has been pressed. With hand-operated devices the switch must be moved to the Off and then to the On position. This provision has materially reduced accident hazards.

Large motors, as used on tube mills in cement plants, pulp grinders in paper mills, and so on are usually started from the plant main switchboard in order to avoid high power peaks. Starting is done on signal from the motor room. Such installations usually have a double set of signals to prevent an operator from signaling for a start, then suddenly deciding to do some work on the machine, and being injured by the motor suddenly starting up.

Another way of providing this protection is to make the motor room signal a momentary-contact device so that the mill operator must hold it closed until the starting operation has been completed.

Rock products plants, extremely safety-conscious, usually include in their control devices an emergency lighting throw-over switch that upon failure of power closes a battery circuit furnishing power to emergency lights. These lights are usually located around stairways, over kiln runways, at the switchboard, in conveyor alleys under silos, at rock crushers, and similar places. They help to prevent operators from being injured in the confusion that may arise from a sudden failure of power, particularly at night.

The emergency battery used with this system is kept charged by a small motor-generator set or large rectifier floating on the line. In some plants the batteries are of sufficient size to supply 40 or 50 60-watt lamps for a period of eight hours.

Motors, generators, control apparatus, and supply cables are well insulated, so that there is no danger of electric shock to operators. However, if the insulation on any of the wiring becomes worn so that the bare wire comes in contact with the metal parts of the machine, a dangerous potential may be built up on the frame. For this reason, all supply cable and apparatus should be well grounded. The importance of installing and maintaining proper ground connections on industrial equipment is not so universally recognized as it should be. Serious accidents often result from unprotected or improperly grounded equipment.

Explosion-proof motors on the transfer pumps make a Texas oil refinery a safer place to work in

Not All Earth Is Good Ground

Merely running a wire into the earth is not sufficient; some kinds of earth do not make a good ground. An illustration of this fact occurred in the grounding of apparatus in a utilty outdoor substation; it was necessary to run a wire for more than a quarter of a mile in order to obtain a suitable ground.

The National Electrical Code describes various suitable methods of grounding. These directions should be followed carefully. After installation, grounds should be checked up by measurement of the resistance frequently enough to make sure that they are in good condition and effective at all times.

Had Skin Troubles

Dirty cutting oil was the cause. Now the oil is sterilized. And that is that

HARRY W. BENTON
Plant Engineer, Pratt & Whitney Company
Hartford, Conn.

ERUPTIONS and diseases of the skin often appear among workers whose duties require the use of cutting oils. When this condition appears in a plant, it is difficult to check by medical treatment, for infection is an ever-present danger. Men working with machine tools must repeatedly expose their hands and forearms to contact with the cutting oil, and since the nature of their work causes frequent scratches and abrasions, trouble, once it appears, quickly spreads.

Searching for the Cause

As plant engineer for a concern manufacturing automobile parts I was brought face to face with this problem a few years ago. One department had 600 automatic screw machines, and several other departments used machines that required the use of cutting oils for the manufacture of steel parts. From the turnings of these machines 32 tons of steel were removed and 4,000 gallons of oil recovered each day of normal manufacturing operation.

Many men had reported for medical attention with pimple rashes that appeared principally on the forearms. These pimples would head up into small pus formations which slight pressure would remove. Once a workman developed this condition, it seemed impossible to stop the spread of the eruption.

The medical department undertook a study to determine the cause of the trouble and devise a remedy. A group of machines, operated by men subject to this rash, were segregated, thoroughly cleaned and sprayed with a powerful disinfectant, then left out of service for 24 hours. Some improvement was noted, but no real cure resulted.

Discovering the Cure

After much study of the research data, the conclusion was reached that a complete remedy could be effected only by sterilization of the reclaimed oil. Provision for this treatment was made, and the results justified the undertaking.

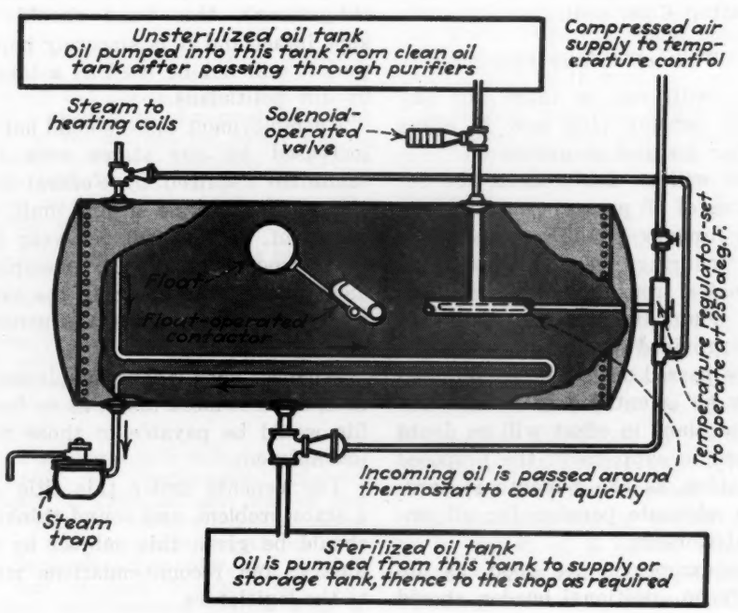
Several years earlier, a 2-story building, 60 feet square, had been erected adjacent to the automatic screw department, to house apparatus for oil reclamation. To this equipment were now added units for sterilizing the oil. A check-up after the installations had been made would have shown separators, sterilizing equipment, oil-storage tanks, and motor-driven pumps for distributing the oil to the department, grouped on the first floor, and a chip-shredding machine and oil-and-chip-separating machines set up on the second floor. Piping conveyed the oil from the storage tanks direct to each screw machine, so that only clean oil was used.

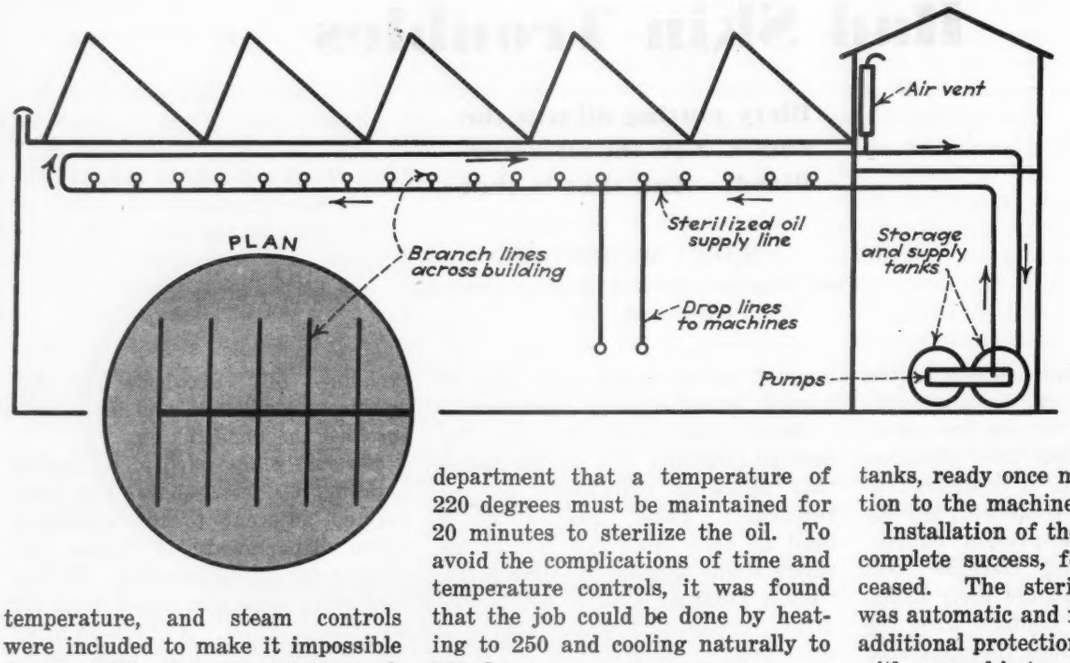
Several times a day, turnings and dirty oil were scraped from the screw machines into steel pans which were routed to the second floor of the new building. Here the chip-shredding machine cut the turnings, and dropped them into a steel pan from which oil drained to a settling tank, suspended near the ceiling of the first floor. A flight conveyor moved the chips from the pan to the separating machines, where the last oil was separated. Chips were then loaded into open freight cars.

Applying the Remedy

This separated oil was added to the oil already in the settling tank. After the water had been drawn off, the oil flowed by gravity to six separators and purifiers which removed dirt and impurities. The oil, now clean, was led into a tank where it remained until pumped into a feed tank above the sterilizer.

The sterilizer consisted of a horizontal 1,500-gal. tank, 6 feet in diameter, containing a steam coil mounted near the bottom. Oil-feed,


Unsterilized oil tank
Oil pumped into this tank from clean oil tank after passing through purifiers
Compressed air supply to temperature control
Steam to heating coils
Solenoid-operated valve
Float
Float-operated contactor
Temperature regulator-set to operate at 250 deg. F.
Incoming oil is passed around thermostat to cool it quickly
Steam trap
Sterilized oil tank
Oil is pumped from this tank to supply or storage tank, thence to the shop as required



temperature, and steam controls were included to make it impossible for any oil to pass through the tank until it had reached a temperature of 250 degrees Fahrenheit.

It had been decided by the medical department that a temperature of 220 degrees must be maintained for 20 minutes to sterilize the oil. To avoid the complications of time and temperature controls, it was found that the job could be done by heating to 250 and cooling naturally to 220 degrees.

From the sterilizing tank the oil was emptied to another tank from which it was pumped to the storage tanks, ready once more for distribution to the machines.

Installation of the sterilizer was a complete success, for the infections ceased. The sterilizer's operation was automatic and foolproof, but for additional protection it was equipped with a graphic temperature recorder to show the temperatures reached and the number of times the sterilizer operated.

New Social Security Bill

(Continued from page 191)

Benefits. None until after two years of the date of the first payment of the Federal tax.

Salary Limitations. None. The tax is based on the full payroll of all employees.

Reserves. Kept by the Federal Treasury.

This bill eliminates such state legislation as the Wisconsin Unemployment Law, Guaranteed Employment allowances, and "Pooled Funds."

Title IX. Taxes (Unemployment Compensation).

Employers. All employers of 10 or more employees, in the calendar year, working one day or any part thereof, in each of twenty weeks (excepting agricultural workers, etc., as under Title II) are subject to excise taxes as follows: 1936, 1 per cent of entire payroll; 1937, 2 per cent; 1938, 3 per cent.

No payroll limitations.

Employees. Not to be taxed by Federal Government. However, the way is open to the states and no restriction placed on them not to do so.

From the above it will be seen that industry will be obliged to pay additional taxes to cover the cost of pensions and unemployment compensation, as follows: 1936, 1 per cent; 1937, 3 per cent; 1938, 4 per cent; 1939, 4 per cent; 1940 to 1942, 4½ per cent; 1943 to 1945, 5 per cent; 1946 to 1948, 5½ per cent; 1949 and thereafter, 6 per cent.

What of Private Plans?

No credit can be taken for any private pension plan now in effect whether insured or uninsured.

This will no doubt mean the revamping of all present pension plans as of January 1, 1937, except those now insuring groups specifically eliminated from the new plan.

No doubt the pension credits already provided through private plans will be passed on to the worker, and surely he is entitled to them. The private plans in effect will no doubt be used to supplement the proposed legislation, as $85 a month is hardly an adequate pension for all employed workers.

The exceptions are good, as obviously no additional burden should be put on non-profit organizations by mandatory legislation. These organizations, where able, will no doubt do what they can to provide pensions for their employees.

While a reserve will be set up due to an accumulation of taxes in the treasury (to be invested in Federal obligations), this fund should be kept intact and it is sincerely hoped that it will not be used as a target by our politicians.

Unemployment taxes should not be increased by our states over the minimum required by Federal law.

There should be a top limit on salary of, say, $3,000 per year for tax purposes under the unemployment part of the new bill, the same as has been done under the pension part.

What we need is more employment first, and not more taxes, as no benefits would be payable to those now unemployed.

The benefits under this title are a state problem, and sound thinking should be given this subject by industry, and recommendations made to the legislators.

Not Enough Power

Says Federal Power Commission, claiming that present utility generating capacity will not carry 1929 level of production

G. A. VAN BRUNT
Associate Editor

A SERIOUS shortage of electrical energy will be experienced in many districts when industrial activity approaches its 1929 level. That is the conclusion reached in the interim report of the National Power Survey of the Federal Power Commission, which was authorized to determine from a national standpoint the relation between present and future requirements for electrical energy, and the capacity necessary to meet that demand.

Generating capacity is sufficient to meet present comparatively low demands by industry, but the report states that the use of power has rapidly increased to the point where the demand in many districts is nearing the limit of available, efficient generating capacity. It takes two years to plan and build a large modern steam generating plant, from two to seven years for a large water-power project. Hence construction of additional generating capacity should be started without delay.

The Commission's Findings

Tentative results of the survey may be very briefly summarized as follows:

1. The use of electricity for domestic purposes and in certain branches of industry has grown at such a rate that, upon a resumption of normal industrial activity, the demand for power will be at least 4,000,000 kilowatts in excess of the 1929 demand. This is equivalent to the capacity of some fifty large generating stations.

2. Little new capacity has been constructed by the privately owned utilities since 1930. As a result the capacity of existing plants is 2,325,000 kilowatts less than the demand that will exist upon a resumption of pre-depression industrial activity, assuming maintenance of normal reserve capacity.

3. The shortage is being rapidly accentuated by obsolescence. As of January 1, 1935, 56 per cent of the total installed steam-electric capacity was at least 10 years old, 11 per cent was 20 years old or older, and about 1 per cent at least 30 years old. Inefficient and obsolete plants with a capacity of at least 2,000,000 kilowatts should soon be scrapped and replaced.

4. With the resumption of normal industrial activity, critical shortages will exist in almost every section of the United States. The only regions in which substantial surpluses of capacity now exist are Florida, parts of Michigan and Illinois, an area along the lower Mississippi, parts of Texas, and North Dakota, Idaho, Utah, New Mexico, Montana, Washington, Minnesota and Oregon.

5. Government plants provided for or under construction will meet these shortages in certain limited areas. Only one major private power development and one major municipal plant are now under construction. Many of the regions where the greatest power markets exist and where the shortage will be most acute do not have projects now under construction sufficient to carry the loads that will develop upon resumption of normal industrial activity.

6. In view of the time required to plan and construct large generating plants, whether hydro or steam, early construction of new plants with an aggregate capacity of between 3,000,000 and 4,000,000 kilowatts is imperative. This would involve capital expenditures of at least $300,000,000.

7. Critical shortage of generating capacity most seriously affects the great industrial districts of the East and Middle West. It would, therefore, be disastrous should the United States become involved in war.

8. Careful planning, under Federal supervision, of new power plants and facilities for transmission is required to promote the safety and welfare of the nation.

The report notes that the 153,000 industrial establishments of the country, including mines and quarries, during the years prior to 1930 consumed about 62 billion kilowatt-hours annually. Of this amount it is estimated that 22 billion kilowatt-hours were generated by industrial plants. Under similar activity, it is estimated that the increase in electrical consumption by industry will be in excess of 5 billion kilowatt-hours; of this increase 3,600,000,000 will be generated in central stations.

Shortages of capacity are indicated in some part of every power zone, the total shortages, allowing for growth of load, being estimated at 2,325,000 kilowatts. Surpluses are also found in some parts of all but one zone, but owing to location or lack of transmission facilities they cannot necessarily be used to offset the shortages.

That is what the survey says about the situation. Spokesmen for the industry criticize sharply, claim that there is considerably more excess generating capacity than indicated by the report, that it will be notably increased when Federal projects start generating. These differences of opinion may well arise honestly enough from failure to see eye to eye in such matters as obsolescence of generating stations.

What Industrial Plants Can Do

Aside from discussing the matter with the local utility, there is nothing that industrial plants can do about the conclusions reached in this report. For its own welfare, however, every plant should study its own power problem. Find out whether to generate or buy power, or do both. This is something to be investigated and decided on the basis of cold engineering and equally cold economics.

If study shows that any or all of the power should be generated locally, selection of the most economical means opens up another broad and important field of inquiry.

Whether power is to be purchased or generated, there still remains the problem of securing maximum efficiency of use. That brings up for study all the uses and the suitability of the equipment involved in heating, lighting, and power application.

The chances are good that a detailed study of the entire problem of power supply and utilization in any plant will show where important economies may be made.

Clutch and Chain Lubrication

When properly done it will go a long way toward enabling these devices to give the low-cost service that is built into them

WILLIAM STANIAR
Mechanical Power Engineer
E. I. duPont de Nemours & Company, Wilmington

LUBRICATION of line- and countershaft bearings and loose pulley bushings was discussed in the April issue. Methods and requirements for the lubrication of friction clutches and chains will now be taken up.

In all types of friction clutches certain parts revolve constantly with the driving shaft, while other parts turn only when the clutch is engaged. The weight of the auxiliary driving member—pulley, gear, or sheave—is carried by a sleeve similar to the manner in which a loose pulley is mounted on a shaft. When the clutch is disengaged this sleeve acts as a bearing and, therefore, requires constant and efficient lubrication to prevent rapid wear.

Two Designs of Clutches

For moderate powers the ordinary friction clutch sleeve acts as a cantilever beam rigidly supported at one end, the remainder or entire length having a running clearance on the driving shaft. Where high power is involved, necessitating heavy pulleys or gears, the cantilever sleeve is not employed. For this service a hollow shaft known as a quill is used, instead of a sleeve. The quill is supported on bearings independent of those on the main driving shaft. The driving shaft passes through the quill with clearance; therefore, contact between the two is eliminated.

When large amounts of power are transmitted and the auxiliary driving members are heavy, the problem of clutch sleeve lubrication is avoided because weight and belt strain are taken by the quill and its bearings.

Sliding collars, trunnion rings, shifter yokes, and various links and pins of friction clutches require a lubricant applied by hand. The friction surface upon which the engagement of the clutch depends may or may not be lubricated, depending largely on the materials used. Where wooden or asbestos blocks engage on metal surfaces lubrication should be avoided, whereas the engagement of metal on metal requires a lubricant.

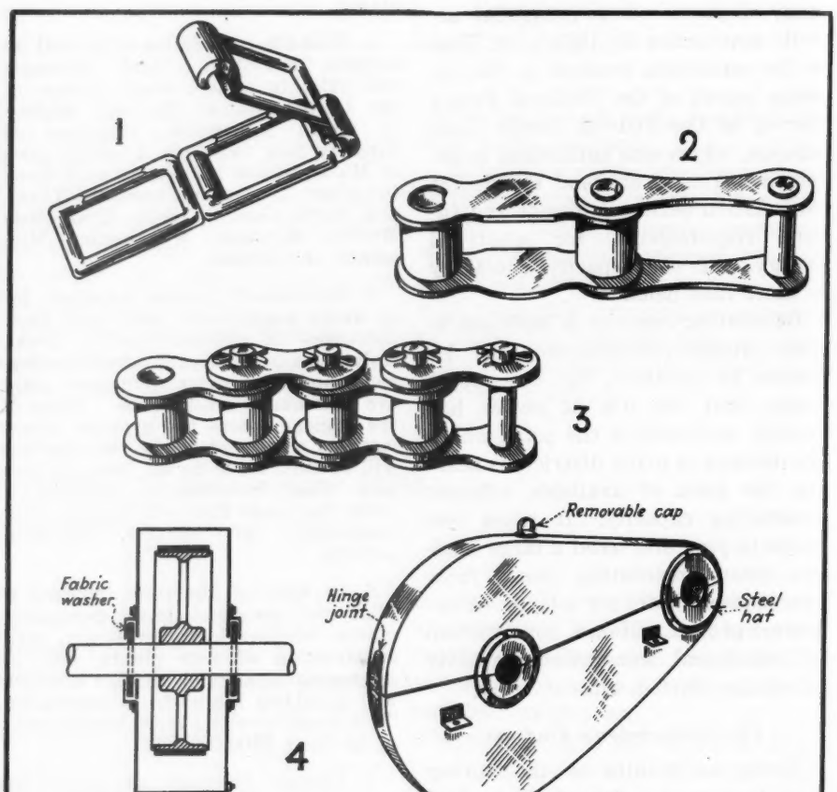


Figure 1. Malleable-iron, detachable-link chain. Figure 2. Unfinished-steel-roller chain. Figure 3. Finished-steel-roller chain. Figure 4. Hat-and-washer-type chain casing

Wet and Dry

Clutches of the multiple-disk type are of two classes, wet and dry. Wet clutches have metallic disks only and require a light, quick-acting oil, commonly known as a spindle oil. If too viscous an oil is employed, excessive slippage will occur.

The dry clutch of this type has alternating disks of various friction materials and metal. These clutches must be protected from lubricants, which will prevent proper functioning of the disks.

From the standpoint of lubrication the sleeve is the most important part of a friction clutch employed on the ordinary group drive using belts. When the clutch is disengaged the sleeve functions as a bearing and must be properly lubricated. Based on required speeds, power capacities, and frequency or severity of operation, clutch sleeve types are available as follows:

1. Cast iron, bored and reamed.
2. Cast iron, babbitted.
3. Cast iron, loose-bronze-bushed.

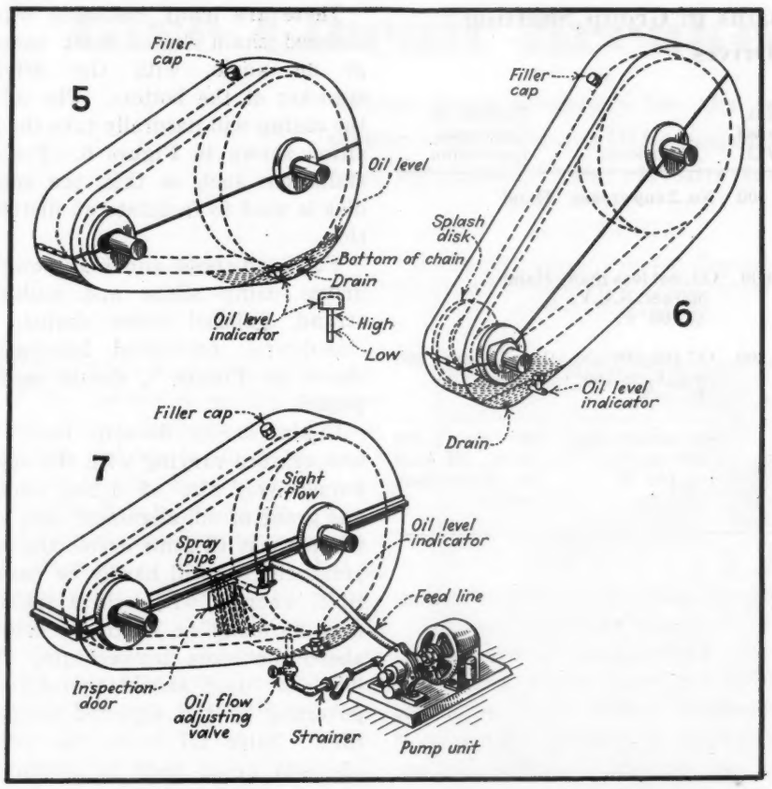


Figure 5. With inclosed, horizontal chain drives it is better to have the bottom of the larger sprocket lower than the other, and dip into the oil. Figure 6. A splash disk is used on inclosed chain drives to get better distribution of the oil. Figure 7. Force-feed lubrication is needed with high-speed chains that transmit large amounts of power

4. Cast iron, capillary-oiling, bronze-bushed.

5. Cast-iron sleeve with ball or roller bearings.

Table I shows the proper lubricant and methods of application for the different types of sleeves under various operating conditions.

Group drives employing shafting and chain are similar to the group shafting and belting arrangement, except that chains are used to transmit power from the lineshaft to the driven apparatus. In this service the friction clutch is employed exclusively for power control. Therefore, the only additional lubrication problem involves the chains.

Differences in Chains

For such drives there are three general types of chains: the malleable-iron, detachable link, Figure 1; the unfinished steel roller, Figure 2; and the finished steel roller, Figure 3. The first two operate on cast-tooth sprockets, whereas the third runs on cut-tooth, accurately pitched sprockets.

For driving light machinery and where the speed does not exceed 400 f.p.m., the malleable-iron, detachable-link chain can be employed. It is inexpensive and although lubrication will prolong its life, it can be operated without such attention.

Unfinished steel roller chain requires lubrication at all times. This type of chain should operate at a maximum of 600 f.p.m. Its power-transmitting capacity is moderate.

The finished steel roller chain, either single or multiple strand, is employed to a greater extent than the other two types in the group shafting and chain method of driving, because of its greater strength, ability to operate at higher speeds, and smoothness of operation. Not only applicable for moderately high speeds, it is most dependable under slow-speed, heavy stresses.

For High Speeds, Oil Lubrication

A chain of this type operates on accurately pitched, cut-tooth steel or cast-iron sprockets and requires constant and efficient lubrication. For long life and low maintenance it should not be operated at speeds exceeding 1,200 f.p.m., in this class of service. At speeds from 800 to 1,200 f.p.m., regardless of pitch, it should be oil lubricated, which can be done most dependably by a steel, oil-retaining casing.

At lower speeds, when the chain is not inclosed, a highly viscous oil should be applied frequently.

The proper lubricants and methods of application for chains in this type of service are shown in Table II.

The direct chain method involves driving the machine equipment directly from the motor, or the direct connection of a motor to head- or lineshafting. The chains employed are the silent, or the multiple-strand, finished-steel-roller type. They operate at comparatively high speeds,

Table I—Friction Clutch Sleeve Lubrication

Type	*Shaft Diam. Inches*	*Max. R.P.M.*	*Service*	*Lubricant*	*Method of Lubricant Application*
Cast iron, bored and reamed	1 to 7½	250	Moderate belt stresses, clutch is engaged most of the time	No. 2 cup grease	Spring pressure cup
Cast iron, babbitted	1¼ to 7½	350	Moderate belt stresses, clutch is disengaged for short periods	No. 2 cup grease	Spring pressure cup
Cast iron loose bronze-bushed	1 to 7	500	Heavy belt stresses, clutch is disengaged for moderate periods	No. 2 cup grease	Spring pressure cup
Cast iron, capillary-oiling, bronze-bushed	1 to 6½	500	Moderate belt stresses, clutch is disengaged for long periods	Oil, 250-500 sec. S.U.V. @ 100° F.	Grease gun
Cast-iron sleeve with ball or roller bearings	⅝ to 5⅞	750	Moderate belt stresses, clutch is disengaged for long periods	Grease not less than 320 Penetrometer number	Grease gun

Table II—Lubrication of Chains in Group Shafting and Chain Drives

Type	*Sprockets*	*Recommended Power Capacity*	*Max. Speed, F.P.M.*	*Lubricant*	*Method of Lubricant Application*
Malleable iron, detachable link	Cast tooth, flint or plain rim. Cast iron or steel	Fractional to 1½ hp.	400	No. 2 cup grease	Hand
Unfinished steel roller	Cast tooth, flint or plain rim. Cast iron or steel	Fractional to 4 hp.	600	Oil, not less than 300 sec. S.U.V. @ 100° F.	Hand
Finished steel roller	Accurate-pitch cut teeth. Cast iron or steel	Fractional to 10 hp.	1,200	Oil 400-500 sec. S.U.V. @ 100° F.	Hand, up to 500 f.p.m.
				Oil, not less than 300 sec. S.U.V. @ 100° F.	500 to 1,200 f.p.m., oil bath by oil-retaining casing

since they are used with motors running at 720 to 1,800 r.p.m.

Chains of this type are composed of a multiplicity of parts with close clearances; therefore they will run better, last longer, and require less attention when given the proper supply of oil, or inclosed in a dust-proof, oil-retaining casing, than if exposed with little or no lubrication.

When running in a normal, clean atmosphere and transmitting moderate power at speeds not exceeding 1,000 f.p.m., a dust-proof, oil-retaining casing for such chains is not absolutely necessary, provided new oil is applied two or three times a week for the first few weeks and once a week thereafter. It is most conveniently applied on the inside by a brush when the drive is running slowly. If applied in this manner centrifugal force will throw the lubricant into the chain joints.

Casings Protect and Lubricate

For speeds higher than 1,000 f.p.m. and where abrasive substances are present, a dust-proof, oil-retaining casing will protect the chain and automatically lubricate it.

Different conditions of operation and installation require different types of oil-retaining casings. Various designs of casings are available, such as the Hat-and-Washer, the Sling, the Textile, and the Light casing, each of which has certain advantages. The Hat-and-Washer type, Figure 4, is the most widely used, because of its ability to protect and lubricate. Under exceptionally severe conditions, as in cement mills or fertilizer plants, the double Hat-and-Washer casing should be used.

The Light casing is usually employed for small drives and where protection, rather than automatic lubrication, is required. However, it can also be used to provide lubrication.

The Textile casing is used for spinning frames, twisters, and so on, where low-powered, high-speed chains are required. To provide continuous, automatic lubrication for such drives a disk is fastened to one of the sprockets and carries a small amount of oil to a V-shaped projection at the top of the casing from which it drips back on the chain.

Just So High

The level of the oil in the casing is important. Where practicable for horizontal drives the bottom of the larger sprocket should be lower than that of the smaller wheel, allowing the back of the chain to dip into the oil at the large end of the casing, as shown in Figure 5. Immersion of the chain in the oil should not exceed ⅛ inch; otherwise excessive heating, foaming, and leakage of oil will occur, particularly if the chain is operating at a moderately high speed.

Table III—Viscosity of Oil for Inclosed Chain Lubrication

Temperature of Air Around Drive, Deg. F.	*Sec. S.U.V. @ 100° F.*
20 to 40	300 to 400
40 to 100	500 to 700
100 to 140	900 to 1,250

There are many instances where inclosed chain drives must operate at an angle, with the driving sprocket at the bottom. The oil in the casing will naturally take the position shown in Figure 6. For installations such as this, the splash disk is used to facilitate oil distribution.

For high-speed and high-powered drives using silent and multiple-strand, finished roller chains, inclosed-type, force-feed lubrication, shown in Figure 7, should be employed.

Chain drives develop heat, the temperature varying with the speed, horsepower, size of drive, amount and grade of oil, alignment, and ventilation. With some drives the temperature rise will hardly be perceptible, whereas with others the rise may normally be 60 or 70 degrees above the room temperature. The lubricant used should therefore be governed by the expected temperature. Table III shows the proper viscosity or oil body to employ for various temperatures.

Variable-Speed Drives, Too

Mechanical variable-speed units are assemblages of moving parts; therefore, regardless of the design and method of operation, they require some form of lubrication. Certain types require bearing and movable disk bore lubrication only, whereas others require that the entire mechanism operate in oil. Units that require bearing and disk bore lubrication are usually equipped for pressure lubrication.

Table IV—Viscosity of Oil for Splash-Lubricated, Variable-Speed Units

Temperature of Air Around Drive, Deg. F.	*Sec. S.U.V. @ 210° F.*
20 to 40	60 to 85
40 to 100	85 to 160
100 to 140	160 to 205

Those that require lubrication by the splash or immersion system are designed with an oil-and dust-tight casing; the viscosity or body of the oil employed is governed largely by the surrounding air temperature. Table IV shows the proper oil viscosity to employ for various temperatures of air around drive.

Give Circuit Breakers a Break

Select them properly for the conditions under which they will be required to protect equipment and circuits from harm

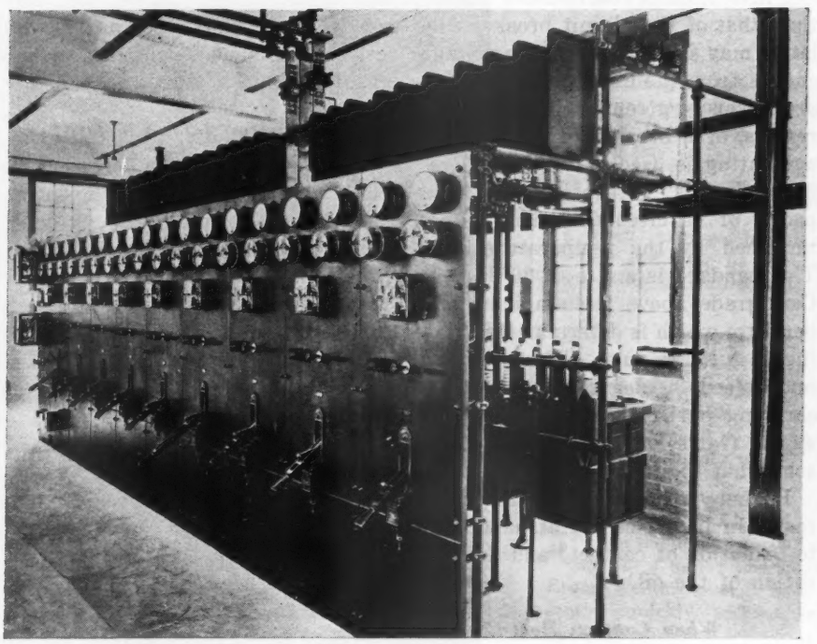
H. J. LINGAL

Manager, Circuit Breaker Engineering
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

WHEN selecting a circuit breaker for industrial use the engineer must choose between an oil-break breaker, and one in which the break is made in air. Each type has a use for which it is best adapted.

Air-break breakers may be used on either a.c. or d.c. circuits, but oil breakers do not work well on d.c. circuits, because they depend on the occurrence of a current zero at which to extinguish the arc. In a d.c. circuit there is no current zero; hence the oil breaker is not well adapted for use on such circuits. To avoid confusion this article will deal only with the selection of oil breakers.

Oil circuit breakers are listed in the manufacturers' catalogs according to voltage rating, current rating, interrupting rating, and short-time, current-carrying capacity. They are usually built for 25 or 60 cycles. Sometimes different types are listed for the same ratings, as indoor and outdoor types. Since the outdoor type of breaker must be weatherproofed, and provision made for greater insulation distances, it is usually somewhat more expensive and occupies more space than a corresponding breaker for indoor use. It is important to decide early whether the breaker is to be used indoors or outdoors.



Oil circuit breakers in a paper mill. These breakers are rated 15,000 volts, 600 amperes, 50,000-kva. interrupting capacity

How Breakers Are Rated

Atmospheric conditions may seriously affect the strength of insulation, and even though the breaker is mounted indoors it may be necessary to select breakers of the next higher voltage rating.

The engineer must consider the interrupting capacity required, since the breaker must be able to interrupt the maximum short-circuit current at the point of application. The short-circuit current at any location can usually be obtained from the power company or from the circuit characteristics. Methods of calculating the short-circuit current are given in breaker manufacturers' catalogs. If assistance is required in determining this value, it can be obtained from their engineers. Breakers built by reputable manufacturers are conservatively rated, and their interrupting capacity is tested under conditions that are usually more severe than those found in industrial circuits. The extra interrupting capacity, however, should be reserved to take care of possible lack of maintenance and unusual or unforeseen conditions.

Breakers are given 1- and 5-second ratings. The 5-second rating in amperes is the maximum r.m.s. current that the breaker can carry for the period of 5 seconds. This value is usually determined by the amount and arrangement of material in the breaker contacts; the limit is usually reached when the breaker rises to a temperature beyond which it is unsafe to continue operation.

The 1-second rating is frequently a mechanical rating: the magnetic stresses in the current-carrying parts reach a value that will distort the contacts or bushings. This rating must not be exceeded, no matter how short the time. Generally a breaker should have a 1-second rating greater than the value of the short-circuit current to be interrupted.

Rate Insulation Conservatively

The external insulation must always be given consideration. Breaker insulation is tested when new at 2½ times the normal voltage rating, plus 2,000 volts. When the insulation is subject to dust and moisture, the effective strength may be considerably reduced. Under adverse conditions a safe rule is to use a breaker

in the next higher voltage class than normally required.

Nominally rated breakers used at altitudes above 3,300 feet must also be derated in the external insulation values. Derating factors are given in catalogs, and also in the A.I.E.E. Standards on Oil Circuit Breakers.

In selecting the voltage rating of a circuit breaker, it is necessary to consider the insulation of the line on which it is to be installed. If the line insulation is considerably higher than that of the circuit breaker, the latter may serve to discharge voltage surges from the line unless adequate protection is given by lightning arresters, or a breaker of higher voltage rating is used.

Continuous current-carrying capacity of oil circuit breakers is determined by the temperature rise. The standard is a rise of 30 degrees Centigrade above the ambient temperature which is determined according to A.I.E.E. rules. The rise must not exceed 30 degrees for current-carrying parts, although such parts as the frame may be allowed to rise somewhat higher.

Higher temperatures will likely result in increased maintenance due to oxidation of contacts and deterioration of the oil.

When Contacts Heat

In applying an oil circuit breaker, remember that the current rating is a maximum continuous value when the carrying parts are in good condition and the breaker is properly adjusted. Oil circuit breakers are capable of carrying overload for a short time and can be so used, with proper caution.

Copper contacts under oil acquire a coating of oxide which, if not periodically removed, will cause excessive heating. Practically all heating trouble in circuit breakers is caused by oxidation of the contacts. Use of silver on the contacts has increased rapidly and helps greatly to reduce overheating. Although silver oxidizes even under oil, its oxide has a very low resistance, whereas the copper oxide has high resistance.

Presence of explosive or corrosive gases may have considerable influence on the selection of a circuit breaker. However, before the proper type of application can be made, the character and amount of the gases must be known.

Breakers are designed for either manual or electrical operation. Manual operation is usually confined to the smaller sizes, since it requires considerable effort to close large breakers. For this and other reasons most breakers are operated electrically, frequently from a remote point. With electrical operation a d.c. solenoid is most commonly used. Other operating means, such as motor drives, spring mechanisms, and so on, are available, but their use is usually not recommended unless conditions make the d.c. solenoid unsuitable.

Manual or Automatic Trip?

Breakers are classified as automatic and non-automatic, the former having some form of tripping device to open the breaker by automatic protective means, such as over-current trip coils, relays, or undervoltage devices, under abnormal circuit conditions. Non-automatic breakers function only when operated manually.

In selecting a tripping means, consider:

1. Type of protection required.
2. Tripping energy available and its reliability.
3. Time factor in opening the breaker.

There are a large number of possible tripping methods, with various ramifications, but fundamentally the principal methods are hand, shunt, or potential trip, transformer trip, under-voltage trip, and series trip.

Hand tripping is usually confined to breakers of small interrupting capacity and is intended only to open the breaker under normal load, or when the circuit is de-energized. All breakers, however, have means for hand tripping in emergency.

The shunt trip is used to control a breaker from a remote point by energizing the coil from a reliable source of power independent of the controlled circuit.

Circuit-closing relays connected to the secondaries of current transformers are used for automatic protection. The relay contact closes a potential circuit energizing the trip coil. The transformer trip derives its energy from current transformers.

Some schemes use circuit-opening relays with the relay contacts normally closed, short circuiting the trip coil. On overcurrent the relay contacts open, causing current to flow through the trip coil.

Another form of trip uses a circuit-closing relay, with the relay contacts normally open. On closing, the contacts short circuit a holding coil, allowing the main trip coil to function. In other forms, the trip coil is connected directly across the transformer secondary. On overcurrent the trip coil will operate. With this type, action is instantaneous unless means are provided to delay the tripping.

Another variation uses tripping reactors; the relays are connected to transformer secondaries, the relay contacts connecting a trip coil across the reactor, to effect tripping.

An undervoltage trip operates when the supply voltage falls below a predetermined value. It can also be used for tripping by short circuiting or opening the potential circuit, either with relays or by hand control. Undervoltage trip is instantaneous, unless time delay features are used.

A series trip is a modified overcurrent trip using a coil in series with the controlled circuit. It is used only on small low-voltage breakers, but is an economical means of obtaining tripping on over-current.

Motor Starting Is Hard Service

Modern breakers are equipped with some form of arc-controlling device which decidedly improves interrupting characteristics and results in: (1) Less oil deterioration; (2) shorter arcing time; (3) faster overall operation; (4) less contact burning; (5) less internal disturbance; (6) reduced maintenance; (7) longer life.

Motor starting imposes severe duty on the contacts of oil circuit breakers; unless they are designed for this service frequent replacement of contacts will be necessary.

An alloy, whose principal ingredients are tungsten and silver or copper, is widely used for contacts operating under severe conditions. This material is expensive and its cost must be balanced against maintenance cost and the necessity of keeping the breaker in service. These special contacts will, however, last much longer than the form ordinarily used in oil breakers.

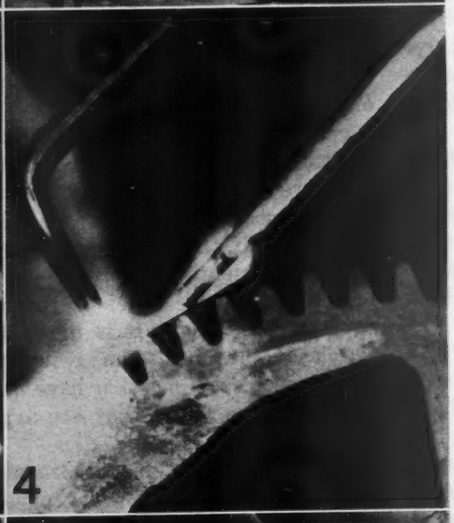
With Rod and Torch

Breaks can be quickly repaired, worn gear teeth built up, and parts hard faced that have to stand punishment

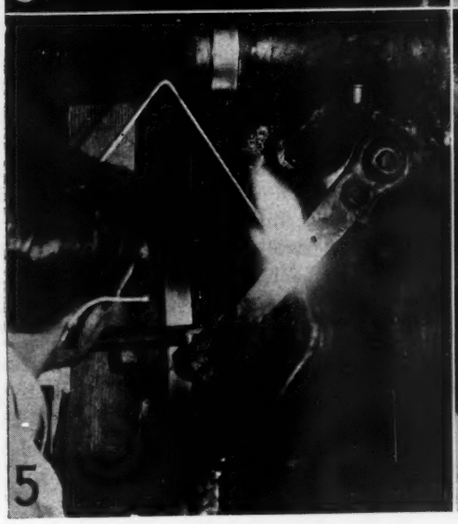
1 When this sump pump motor frame cracked it was quickly and permanently repaired by bronze-welding

2 Repairing broken coal conveyor screws by oxy-acetylene welding is routine work in many plants

3 When castings are faulty they can often be reclaimed by welding at considerable saving



4 The torch and rod do a job of dental surgery on gears, replacing broken teeth, building up those badly worn



5 When the pump breaks down it's not a major catastrophy. Bronze-welding puts it back in service quickly without even dismantling

6 Where building service pipes are designed for permanent leak-proof installation the joints are welded

For Motors, This Maintenance

Reliable service and low-cost operation are obtained only when equipment is carefully inspected and given proper attention

C. L. KEENE
Supervising Engineer
The Ocean Accident & Guarantee Corporation, Ltd.
New York

SERVICE conditions determine the required frequency of motor and generator inspections. A motor located in a damp place or subjected to injurious elements, such as dust, oil, acids, or alkalies, requires more frequent inspection and attention than one operating under more favorable conditions. Open-type machines operating under extremely severe conditions may require a certain amount of cleaning each day. In general, however, a weekly inspection and cleaning with compressed air is recommended. More thorough inspections should be made not less than once every three months, and should include insulation resistance and air-gap clearance measurements.

Motors of the totally inclosed type, or those in which the air gap and windings are normally inaccessible for examination, should be opened yearly, oftener if the service is severe, for inspection and to check bearing wear.

Motors in Dirty Places

Inclosed generators with open ventilating systems should also be opened annually for inspection and cleaning. Special attention should be given to machines operating in places where the air is contaminated with lint, coal or ash dust, cement dust, and the like. Such machines may have to be opened more frequently. Several serious turbo-generator failures have been caused by carbonized dirt and oil deposits between and under the stator and rotor end turns.

It is considered unnecessary to open inclosed machines with closed ventilating systems more than once every two or three years, except in special cases. On all turbo-generator examinations, however, the inspection plates, if provided, should be removed and all visible parts closely examined with the aid of good light.

Machines of the open type operating under average conditions should be taken out of service annually for complete overhauling. The rotor or armature should be pulled and all parts carefully cleaned. The windings should be dried and then given one or two coats of a good grade of insulating varnish, preferably applied with a spray gun or by dipping.

Damp insulation is responsible for more generator and motor breakdowns than any other single cause. When a machine stands idle for some time, its windings absorb moisture. The quantity absorbed depends upon the humidity, the kind and condition of the insulation, and the time out of service. The heavier the coat of insulating varnish, the longer it takes moisture to penetrate it. However, varnish coatings are not moisture proof, and if the machine is out of service sufficiently long, its windings may become damp unless proper precautions are taken. It is important to check the insulation resistance and inspect machines that have been out of service before they are again started.

Windings must be thoroughly dried before they are varnished. Moisture sealed in can be driven off through the varnish with great difficulty and may cause a failure.

When Windings Are Wet

Many motors are subjected to steam, dampness, and water under normal operating conditions. For such machines special insulating varnish and treatments have been developed that will help greatly to decrease failures due to dampness.

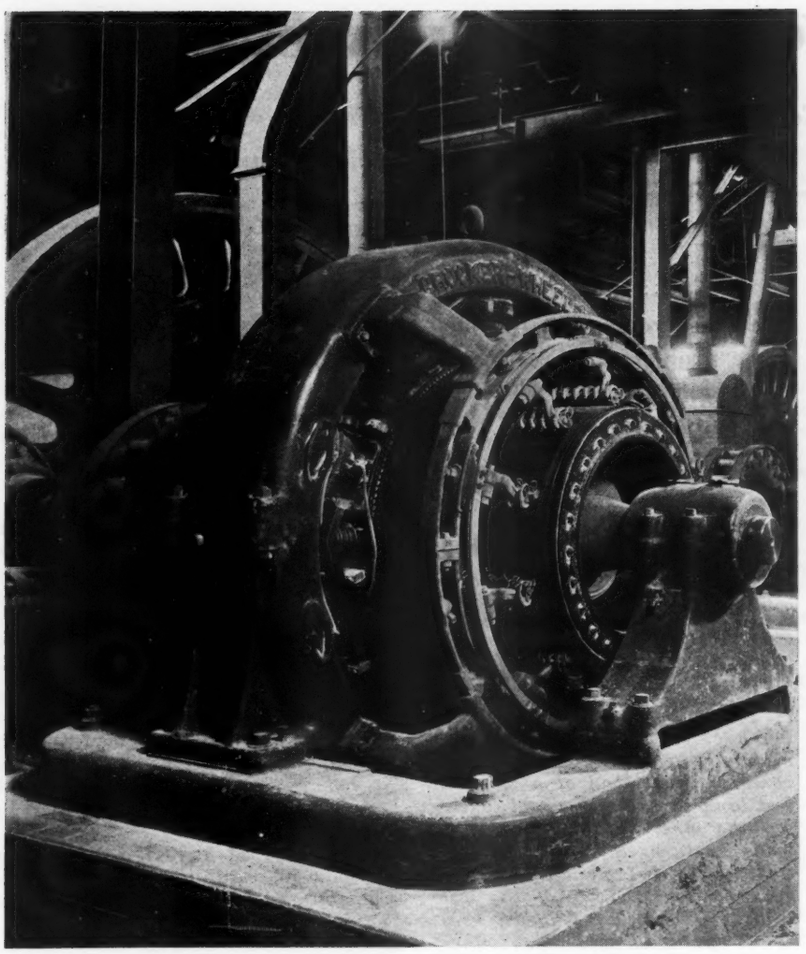
Motor or generator windings that have become damp should be completely dried out. This can be done by placing lampbanks, or strip or glow heaters, around or in the machine and covering it with canvas, leaving an opening at the top to permit the escape of moisture. The best results are obtained when there is a good circulation of air over the winding surfaces. If necessary small ventilating fans may be used to provide the required circulation.

Dry Them Carefully

The most effective method of drying out a damp machine, particularly large high-voltage machines, is to pass a current through the winding, using a voltage low enough to be safe for the moistened insulation. For example, use 220 volts to dry out a 2,200-volt motor.

While drying out, the temperature of the windings should be closely checked. It should not exceed 100 degrees Centigrade when the winding is dried externally, or 90 degrees when passing current through it. Insulation is the most vulnerable part of electrical machines, usually requires the most attention. The best insulation deteriorates with time and usage, and this process is accelerated by abnormal temperatures, vibration, dirt, oil, and so on. As will be seen from the table, the majority of electrical breakdowns are directly due to insulation failure.

On inspection, all visible portions of windings should be scrutinized for cuts, bruises, or defects. Weak or bare spots should be taped or otherwise re-insulated. The cleanliness and condition of the insulation should be noted. Extremely dry and brittle insulation should be given one or two coats of varnish. Dust should be blown out with dry compressed air, at a pressure not exceeding 40 pounds per square inch. If windings are covered with abrasive dust, use a lower pressure or, better, a suction or vacuum system. With high air pressure, abrasive particles may be driven through the insulation and cause trouble.



Causes of Motor and Generator Failures

Cause of Failure	*Number of Failures*	*Percentage of Total Accidents*
Breakdown of insulation on windings, all causes*	101	31.76
Breakdown of insulation on commutators and collector rings, all causes	18	5.66
Dampness	21	6.60
Single-phasing, all causes	18	5.66
Lightning and line surges	8	2.52
Overheating, due to overloads or other causes	13	4.09
Loosening or breaking of connections, band wires, etc., and movement of coils	23	7.24
Faulty operation due to carelessness	8	2.52
Miscellaneous electrical causes	15	4.71
Total failures due to electrical causes	225	70.76
Defective or worn bearings, or inadequate lubrication	41	12.89
Entrance of foreign objects	8	2.52
Breakage of mechanical parts and miscellaneous mechanical causes	24	7.54
Total failures due to mechanical causes	73	22.95
Undetermined causes	20	6.29
Total	318	100.00

*Many of these failures were in reality due to moisture.

With d.c. machines, many insulation failures are caused by dirt and other deposits at the rear of commutators and risers, particularly when equalizers are installed. Uneven areas or pockets at these points catch foreign material in the ventilating air. These spaces are usually difficult to examine, but should be checked for cleanliness, especially if the machine shows low insulation resistance.

Once in a While, A Bath

Sticky dirt and oil should be removed from insulation with naphtha, kerosene, gasoline, carbon tetrachloride, or other solvent. Carbon tetrachloride is recommended, since it is not flammable, but with any cleaner good ventilation is required; hence, it is advisable to do the work outdoors.

A heavy, stiff brush is useful in removing the heaviest deposits before applying the cleaning fluid. Small bristle brushes may be used to clean out ventilating ducts and small recesses. The liquid may be applied with a cloth or a brush, or sprayed on. The insulation will dry quickly at ordinary temperatures, but it is advisable to drive off all moisture by heating if varnish is to be applied.

Oil is injurious, and can reach the windings from many sources. Often leaky bearings are responsible. Leakage can usually be stopped by installing new shaft seals, or felt or rawhide retainers. Constant-level oilers are of value, when attendants habitually fill the bearings too full. Bearing drain plugs should be kept tight. Working parts of machines that give off oil vapor should be inclosed and oil vents piped outdoors.

Many breakdowns of revolving electrical machinery are caused by loose wedges or coils, and broken or loose banding wire. These parts should be checked for tightness. If a coil becomes loose, it moves, so that gradually the insulation is worn away and failure takes place.

Loose cordage and spacer blocks for the end turns of the stator windings of large a.c. machines are occasionally the cause of trouble.

(In a succeeding article, to appear in an early issue, methods of inspecting and testing insulation and other parts of motors and generators will be discussed.—Ed.)

Questions *and* Answers

Conducted by G. A. VAN BRUNT

?

What are your most troublesome problems? Free-for-all discussion of them will help you and other readers

Methods of Cleaning Motors

I wish that readers would tell me what materials and methods they have found most suitable from the standpoint of efficiency, fire hazard, cost, and so on, for cleaning motors out in the plant, and in the repair shop. The coils of some of our motors get quite oily and dirty; others are exposed to a starch-like dust that becomes sticky when wet and dries to a hard crust. Water will slowly dissolve this crust, but I have been afraid to use it. Is it ever advisable to clean motors, or their windings with water? H.N.R.—Minneapolis

AFTER having tried many different ways of cleaning dirty motor windings we have reached the conclusion that there is but one way to do a really thorough job.

We use mineral or paint spirits to dissolve the grease, oil, and dirt on the windings. This liquid is the same as that used in most clothes cleaning establishments. It is flammable, but not explosive under ordinary conditions.

After the grease and dirt have been removed compressed air at a pressure of 90 lb. per sq.in. is applied. It blows off any foreign material and leaves a clean but slightly damp winding. Then about an hour of baking at 100 deg. C. is sufficient to make a very good job.

If the winding needs it a dip or brush coat of clear insulating varnish is applied after the winding has been dried, and then baked.

RUSSELL GARDNER
Bosler Electric Company
Salem, Ore.

How Splice Resistance Wire?

Can someone tell me whether, or how, Nichrome resistance wires can be joined together? Quite frequently I want to splice two pieces of such wire, or put on taps, but I have found no satisfactory way of doing it. The temperature of the wire will not exceed 1,000 deg. F. F.H.—Albert, W. Va.

A SPLICING compound has been used with good results on the resistance wires of electric heaters. This compound, which comes in powder form, is applied to the splice or tap and the current turned on. The heat of the joint melts the powder so that it runs over the joint like a soldered connection. The tap or splice is then ready for service.

When using this compound, which is known as Fuselle and is manufactured by the University Laboratory, Box 344, Evanston, Ill., no special preparation or method of splicing is necessary.

CLARENCE W. HOPE, *Lowell, Mass.*

Answers Wanted

•

Do These Sparks Mean Anything?

While testing a three-phase squirrel-cage motor for grounds by connecting one lead of a 220-volt test lamp to the frame and touching the other lead to the motor leads in turn, the lamp did not light up, but I noticed a slight sparking when either of the test leads was moved. That is, very small sparks showed when either the lead on the motor frame or the one touching the motor leads was moved. Does this sparking indicate that there is a high-resistance ground in the winding? Since the motor seems to operate satisfactorily, would it be safe to put it back in service?

R.B.—Lafayette, Ohio

Two-Wire Meter, Three-Wire Circuit

It will be appreciated if someone will tell me whether, or how, a 5-amp., two-wire, 110-volt watt-hour meter can be connected to measure power consumption accurately on a single-phase, three-wire, 110/220-volt circuit. The load on this circuit is about 200 amperes. What should be the ratio of the current transformers?

A.N.—Three Lakes, Wis.

Mating Steel and Cast-Iron Flanges

I have been told that when erecting pipe lines it is not advisable to mate a steel pipe flange with a cast-iron flange. Can anyone tell me whether this is true? If so, why? R.R.—Indianapolis

I HAVE had good success in splicing resistance wire by welding it. After the splice has been made, heat the wire by passing current through it. After it has become red hot put a small amount of bicarbonate of soda (baking soda) on the splice.

Another good way of making a tap or joint in resistance wire is to braze the splice, using borax and a piece of brass rod.

A. G. FULLER, *Ajo, Arizona*

Frost Forms on Commutator

We are having trouble with frost forming on the control board and commutator of the hoist motor on our coal bridge, after it has been idle for some time. I should like to know from the experience of other readers whether there is any better way of removing it than by the use of a blowtorch. What is the best way to prevent its formation? H.J.E.—Duluth, Minn.

IF THIS is a d.c. motor it can be kept free from frost by keeping the shunt field coils excited during periods of idleness. The heat provided in this way will keep the entire motor warm and dry. Of course, a discharge resistor in conjunction with a single-pole, double-throw switch will have to be used for disconnecting the field from the current supply, in order to avoid rupturing the field insulation. We use this method to keep a spare motor dry and ready for use.

The control board can be kept dry and frost-free by providing a suitable inclosure for it and using a small heater or lamps mounted at the proper points on the board.

J. G. CRAFT, *Electrician-in-charge*
Coast Copper Company, Ltd.
Jeune Landing, B. C., Canada

EQUIPMENT NEWS

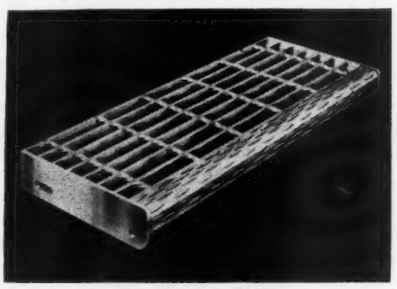
Floor Plate

Called "Multigrip." For anti-skid surfaces. Small raised lugs have flattened top surfaces. Manufacturer claims comfort under foot and positive skid resistance whether wet or dry. Lugs close enough so that truck wheels will not catch. Thicknesses, 3/16-¾ in.; widths, 6-84 in.; lengths, 120-480 in. Illinois Steel Co., 208 S. La Salle St., Chicago.

Vulcanizer

For vulcanizing splices of Compass Cord transmission belts. Core of cords is dovetailed and vulcanized to make belt endless. Portable. Goodyear Tire & Rubber Co., Akron.

Stair Tread



Electroforged steel. Designed for strength against impact. Twisted cross-bars give protection against slipping. Nosing of rolled diamond-checkered plate. Blaw-Knox Co., 2031 Farmers Bank Bldg., Pittsburgh.

Cleaner

Vacuum. Can be used for blowing and spraying. Dirt, scrap, filings, etc., are drawn first into 12-gal. aluminum-finished steel tank where heavy materials settle, leaving fine particles to be drawn into dust-proof bag. Universal 1-hp. motor (110, 220, or 250 volts) and 7-in. fan which creates vacuum of 46½-in. waterlift. Flexible duck-covered hose 10 ft. long, 1¼ in. diameter. Special attachments available for cleaning all sorts of equipment. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Hose Valve

Automatic. For free-end hose or overhead washer. Has brass female connector threaded to fit any standard water hose connection, built-in, replaceable valve, and 6-in. gum-rubber connection, ¾-in. diameter. Valve is released when hose is taken in hand. When hose is returned to normal position water pressure closes valve. Hunt Mfg. Co., 1619 Winona Ave., Chicago.

Meter

Fuel flow—air flow. Makes possible maintenance of definite relation between amounts of air and fuel supplied to furnace. Differential pressure in supply lines motivates mechanical mechanism actuating two recording pens. Preliminary test and adjustment set meter so that coincidence of pens indicates best combustion conditions. Meter also indicates rate of flow and total flow. Integrator for total flow actuated by a.c. current of regulated frequency or spring-driven clock. Auxiliary temperature or pressure recorders may be included to record on same chart. Pressed steel casing suitable for flush-front or surface mounting. Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland.

Excavator

Model 100 "Bantam Weight." Capacity, ⅜ yd. Ford V-8 truck motor or deisel power. Travel speeds, 1½-3 miles per hour; swing speeds, 5 r.p.m. Manufacturer claims easy convertibility to dragline, crane, hoe, skimmer, or pile driver service. Harnischfeger Corp., Milwaukee.

Time Recorder

Called "Simplex Electro-Touch Recorder." Registering plate above card-receiver is touched by hand holding card, and electric mechanism records time. Manufacturer claims for instrument recording speed and long life through uniform recording stroke. Steel case with special finish and chromium-plated trimmings. Simplex Time Recorder Co., Gardner, Mass.

Hydraulic Jack

Called "Porto-Power." Adaptable to a variety of jobs. Ram, pump, and press units mounted separately on movable stand. Six-foot flexible hose connects ram and pump so that pump may be removed from stand. Seven-ton power may be delivered in any direction. Precise work can be done on press through controls of ram plunger and pump stroke. Thirty attachments widen use of unit. Jack can push, pull, spread, clamp, press, and straighten. Ram unit weighs 10 lb., is 11⅜ in. long, has diameter of 2¼ in. Blackhawk Mfg. Co., Milwaukee.

Tractor

Gasoline; called "Type D." Large-size pneumatic tires front and rear. Double rear tires for greater traction and greater cushioning effect. Overall length, 86 in.; width, 60 in.; turning radius, 115 in. Mercury Mfg. Co., 4118 S. Halsted St., Chicago.

Water Coolers

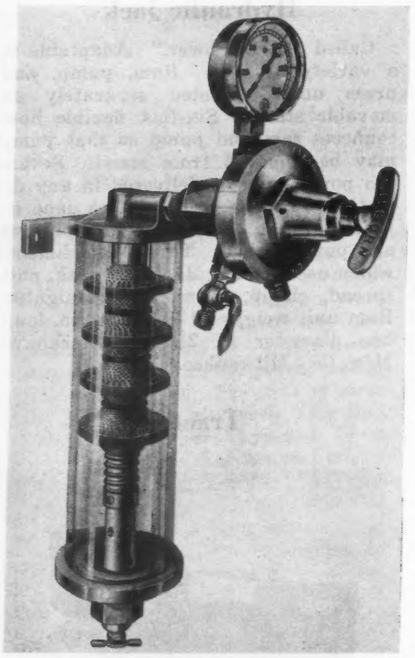
Line of 10 models with foot-pedal operation. Bottle and pressure types. Capacities, 3-57 gal. per hour. Chrome-plated guards shield faucets from soiled hands and dirt. Rust-proofed steel cabinets finished in bronze with chromium fittings. Splash-proof drain. Two models have refrigerated cabinets with finish of acid-resisting porcelain. General Electric Co., Nela Park, Cleveland.

Magnet Protector

Electronic device designed to prevent insulation breakdown in direct-current magnets, solenoids, shunt- and compound-wound motors and generators, coils, etc., due to self-induced, high-voltage surges. Connected directly across equipment to be protected. No current flows until voltage reaches dangerous value; then protector suddenly conducts and shunts out surge.

Called "Magnet Protector Tattelite." Littelfuse Laboratories, 1772 Wilson Ave., Chicago.

Filter



For purifying air or gas. Series of perforated plates and strainers, inclosed in glass shell, removes foreign substances from air or gas lines. Accumulations of oil, moisture, and dirt can be easily seen and removed. Equipped with 3-in. diaphragm regulator having a graduated gage. The Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore.

Screwdriver

Electric. Called "Torsimeter." Has clutch arrangement which enables operator to determine amount of torque to be applied. After adjustment is made, clutch automatically releases at same tension point on each screw. Adapted for self-threading screws, all types of metal and wood screws. Black & Decker Mfg. Co., Towson, Md.

Flow Gun

Designed for striping and flowing sealing compounds, cements, and plastic materials. Nozzles built to user's specifications. Flow controlled by regulation of pressure or by adjustment of fluid-needle travel. Small, operated by either thumb or index finger. Called "Type Flow Gun." The DeVilbiss Co., Toledo, Ohio.

Electrode

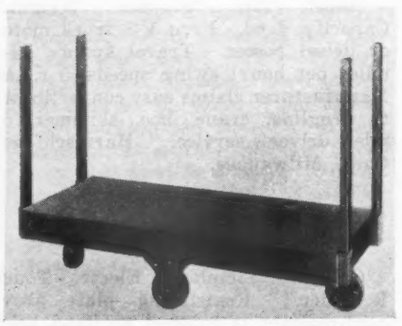
Arc-welding. Deposits abrasion-resisting, self-hardening alloy. Maximum hardness developed at surface where deposit is cold worked. Said to be corrosion-resisting and not materially altered in physical properties if forged hot. Applicable to gear and pinion teeth. Size, 3/16 in.; length, 14 in. Used wth reversed polarity and current range of 125-200 amp., 24-27 arc volts. Called "Abrasoweld." The Lincoln Electric Co., Cleveland.

Woodworking Machines

Improved band saw and jointers. High-speed, 16-in. band saw has lineal speed of 5,000 ft. per min. (1,200 r.p.m.). Upper wheel guarded; light mounted directly above working area. Jointers, 6- and 8-in., have speed of 5,000 r.p.m., giving 15,000 cuts per min. with 3-knife head of 6-in. model, 20,000 cuts per min. with 4-knife 8-in. model. Motor of 1,800 r.p.m., 60 cycles. J. D. Wallace & Co., 134 S. California Ave., Chicago.

Truck

All steel, platform truck for general factory use. Heavy-gage sheet steel formed into inverted box section and reinforced with 4-in. channel struts. Stakes of 2x½x⅛-in. channels. Casters of pressed steel. All-welded construction. Battleship grey enamel, baked on. Stackbin Corp., Providence, R. I.



Rake

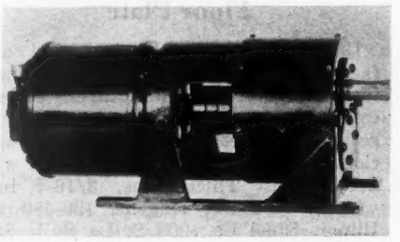
Magnetic rake for removing iron particles from enamel dip-tanks. Rake is drawn through enamel once an hour to keep the enamel clean and increase the length of use of a batch. Magnets may be remagnetized. Ferro Enamel Corp., Cleveland.

Hoist

Employing helical-gear drive. Main frame of rolled steel. Gears and shafts of alloy steel. Gears totally inclosed, run in oil. Cam-controlled disk brake on motor can be operated by ropes or remote control. Load brake of alloy steel has two of four pawls always engaged to insure safety. Cable drum will take entire cable in machined grooves without overlapping. Euclid-Armington Corp., Euclid, Ohio.

Reduction Unit

Helical gear reducer. Called "Lectrigear." Sizes ranging from ½-2 hp. Furnished with or without motors.



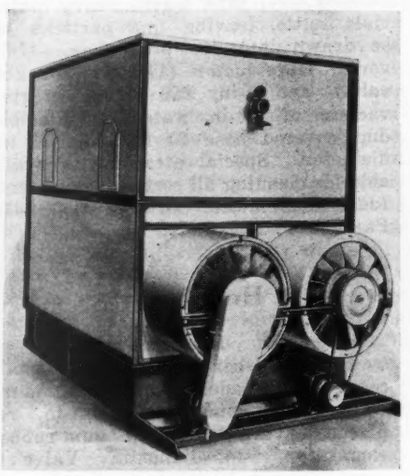
Standard footless motors used without changes in shaft or bearings. Ajax Flexible Coupling Co., Westfield, N. Y.

Automatic Welder

For metallic arc welding with heavily coated electrodes. Tangential-grip feed rolls feed electrode. Straightener eliminates frictional wear on cadmium-copper contact inserts. Toggling, free-passage contactor allows passage of foreign matter and prevents current and heat conduction to mechanical control. Take-off reel has sliding ground contactor which makes use of high resistance of electrode coil to balance variable resistance of arc. Electrode consists of solid core upon which is woven wire mesh whose pockets are filled with flux. This mesh allows passage of high currents to core at contact point. Negative electrode. Woven welding wire of five sizes furnished in coils. Push button control. The Welding Wire Co., 28 Harvard St., New Britain, Conn.

Cooling Towers

For cooling condensing and circulating water. Eight sizes ranging 5-150 gal. per min. Water delivered to system of nozzles arranged to provide wide degree of water breakup and distribution under low pressure. Interior air deflectors for unifom distribution. Tower housing of heavy-gage, gal-



vanized, copper-bearing steel sprayed with two coats of aluminum paint. Fan of aluminum alloy. All sizes furnished with fan and fan motor; also water pump if desired. Large sizes in sections; 5- and 10-gal.-per-min. sizes are self-contained units. Binks Mfg. Co., 3114-40 Carroll Ave., Chicago.

Excavator

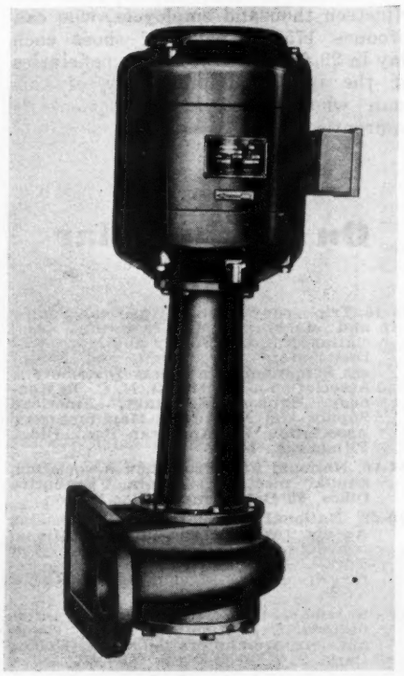
Model 350 "American Gopher." Capacity, ½ yd. Gasoline, deisel, or electric operation. Travel speeds up to 1¾ miles per hour; swing speeds to 5 r.p.m. Convertible for shovel, dragline, crane, etc. American Hoist & Derrick Co., St. Paul, Minn.

Holder

For steel strapping. Steel pan mounted on casters. Manufacturer claims that retainer is especially adapted for use with conveyors or strapping tables where space is limited. Dimensions: diameter, 24½ in.; height, 9½ in. Acme Steel Co., 2840 Archer Ave., Chicago.

Pump

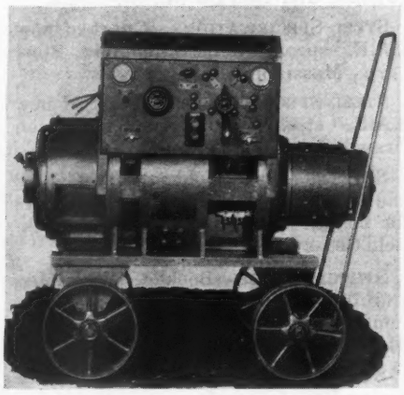
Can be installed without piping. Pump is mounted directly on machine so that all piping is confined within machine. Five cap screws secure pump to mounting pad and 2½-in. discharge



outlet is connected to machine reservoir by threading, calking, welding, etc. Pump capacity, 150 gal. per min.; motor, 1 hp., 1725 r.p.m. No metal-to-metal contact within pump. Model No. 11027. The Ruthman Machinery Co., Cincinnati.

Welder

Called "Universal Staid—Arc Welder." Welding current controlled by 600 settings. Manufacturer claims that



welder is ruggedly built and will deliver full welding range when started cold. Universal Power Corp., 1719 Clarkstone Rd., Cleveland.

Lamp Fixture

Designed for mercury-vapor lamps in general interior lighting and special lighting of high narrow rooms. Porcelain-enameled, steel dome-shaped reflector for broad light distribution, or aluminum reflector in both concentrating and spread types. Both fixtures used with 400-watt high-intensity lamp. Both furnished with Benjamin "Socket-Reflector" construction or "Turnlox" feature. Benjamin Electric Mfg. Co., Des Plaines, Ill.

Capacitors

Three types, for power-factor correction. "Box" type for voltages between 230 and 575, 60 cycle, has ratings from ½-10 kva. "Small Rack" type, for indoor and outdoor installations, consists of several large capacitors mounted on angle-iron framework with screen covers. Will handle 30-240 kva. at 230-4,600 volts, 60 cycles. Dimensions: base, 2½x2 ft.; height, 3-6 ft. "Large Rack" type rated as high as 1,200 kva., for all standard voltages 230-6,600. Dimensions: 3 ft. wide, 7 ft. high, 3-10 ft. deep. Cornell-Dubilier Corp., 4377 Bronx Blvd., Bronx, N. Y.

Welder

Called "75 Ampere Hobart Arc Welder." For light-gage welding. Has welding range of 15-125 amp. in 3 steps. Rated at 75 amp., 25 volts. Manufacturer states that arc is tenacious down to minimum current with which it is practical to weld. Motor, 3 hp., 1,750 r.p.m. Machine of arc-welded construction. Portable model mounted on welded-steel truck. The Hobart Co., Box 4135, Troy, N. Y.

TRADE LITERATURE

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AIR CONDITIONING — Bulletin No. 2967, describing cooling and air-conditioning units.—Buffalo Forge Co., Buffalo, N. Y.

BELTS—Folder, listing improvements in belt construction.—The B. F. Goodrich Co., Akron.

CABLES — Bulletin No. LS-1, on vacuum process lead sheath; bulletin No. UC-1, on non-metallic and metallic armored cable.—General Cable Corp., 420 Lexington Ave., New York.

CAPACITORS — Bulletin No. 127, describing three capacitor units.—Cornell-Dubilier Corp., 4377 Bronx Blvd., Bronx, N. Y.

CARBON MONOXIDE — Booklet, title "Carbon Monoxide—the Killer."—Mine Safety Appliances Co., Braddock, Thomas, and Meade St., Pittsburgh.

CEMENTED CARBIDE—Catalogue Supplement SC-35, title "The Profitable Use of Carboloy." Also booklet, "Complete Information on the Profitable Use of Carboloy Tools."—Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit.

CLEANER—Leaflet, announcing portable industrial cleaner.—Ideal Commutator Dresser Co., 1209 Park Ave., Sycamore, Ill.

CONDENSATE UNITS — Bulletin 260-B14, dealing with condensate units.—Roots-Connersville Blower Corp., Connersville, Ind.

COUPLING — Leaflet, describing L-R flexible Coupling Type "P."—Lovejoy Tool Works, 4963 W. Lake St., Chicago.

CUTTING MACHINE—Folder, describing Model 302 Horizontal, Wet-Abrasive Cutting Machine.—Andrew C. Campbell Division of American Chain Co., Inc., Bridgeport, Conn.

DRAWN STEEL—Folder on cold drawn steels.—Union Drawn Steel Co., Massillon, Ohio.

EXCAVATOR—Catalog No. 77, covering "American Gopher" crawler-type excavator.—American Hoist & Derrick Co., St. Paul.

EXCAVATOR—Bulletin 100, describing "Bantam Weight" excavator. — Harnischfeger Corp., Milwaukee.

FLOOR PLATE—Folder, announcing Multigrip floor plate.—Illinois Steel Co., 208 S. La Salle St., Chicago.

GRINDING MILLS — Folder, on mill linings and grinding balls.—The Patterson Foundry and Machine Co., East Liverpool, Ohio.

HOSE — Leaflet, showing Paranite hose, an oil-loading hose.—The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

HOSE VALVE—Leaflet, describing automatic hose valve.—Hunt Mfg. Co., 1619 Winona Ave., Chicago.

LIGHTNING ARRESTERS—Booklet, title "Crystal Valve Lightning Arresters." —Electric Service Supplies Co., 17 and Cambria St., Philadelphia.

LOCKERS — Catalog No. 28-A-1, on steel lockers.—Fred Medart Mfg. Co., Potomac and DeKalb St., St. Louis.

LOCK NUTS—Charts, listing lock nuts and washers for use with bearings.—The Timken Roller Bearing Co., Canton, Ohio.

LUBRICATION—Bulletin No. PT-124, title "Power Transmission Equipment and Its Lubrication."—Technical Dept., Standard Oil Co. (Indiana), Chicago.

MAGNETIC RAKE—Folder, describing rake for removing iron particles from enameling tanks.—Ferro Enamel Corp., Cleveland.

METAL—Bulletin No. 301, describing "Truflex" thermostatic bimetal.—General Plate Co., Attleboro, Mass.

METER—Folder, describing universal recording meter for measuring fluids.—The Foxboro Co., Foxboro, Mass.

PIPING—Bulletin, dealing with the design of piping systems.—Tube-Turns, Inc., 465 S. 5 St., Louisville, Ky.

PLATING BARREL—Folder, announcing plating barrel.—The Udylite Co., 1651 Grand Blvd., Detroit.

PLYWOOD — Catalog No. 4-D-2, on Plyform, a special plywood for concrete form construction.—Wheeler Osgood Sales Corp., 122 S. Michigan Ave., Chicago.

PUMP—Bulletin W-323-B3, on self-priming, centrifugal, Monobloc pumping units.—Worthington Pump and Machinery Corp., Harrison, N. J.

PUMP — Bulletin, title "Ace Hard Rubber Centrifugal Pump — Type WAM for Acid Handling."—American Hard Rubber Co., 11 Mercer St., New York.

PUMPS—Bulletin W-311-B1B, on single-stage volute, Type R, centrifugal pump.—Worthington Pump and Machinery Corp., Harrison, N. J.

PYROMETERS—Folder, describing potentiometer pyrometers.—The Brown Instrument Co., Philadelphia.

RECORDERS — "Solving Industrial Crimes," Case No. 6, describing recording apparatus.—The Esterline-Angus Co., Indianapolis.

REDUCER—Book No. 1515, on motorized reducer.—Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia.

SPRAY EQUIPMENT—Bulletin AD-114, describing line of spray equipment.—Binks Mfg. Co., 3114 Carroll Ave., Chicago.

SPRAY-PAINTING — Folder, showing spray-painting equipment. — The DeVilbiss Co., Toledo, Ohio.

STEEL—Stock list of steel and boiler tubes.—A. B. Murray Co., Inc., 147-165 Wolcott St., Brooklyn, N. Y.

STEEL PLATE—Booklet, title "World's Largest Plate Mill and Its Products." —Lukens Steel Co., Coatesville, Pa.

STEEL SHELVING — Catalog 56, on steel shelving.—Fred Medart Mfg. Co., Potomac and DeKalb St., St. Louis.

STEEL SPECIFICATIONS—Chart of new S.A.E. specifications.—Republic Steel Corp., Massillon, Ohio.

STEEL SPECIFICATIONS—Chart of new S.A.E. steel specifications. — Union Drawn Steel Co., Massillon, Ohio.

STOKERS—Two Folders, Nos. 1458 and 1459, describing underfeed stokers for boilers of less than 300 hp.—Link-Belt Co., 2410 W. 18 St., Chicago.

SWITCH BOXES—Booklet, describing and illustrating switch boxes. — National Electric Products Corp., Fulton Bldg., Pittsburgh.

SYNTHETIC RUBBER — Pamphlet, giving list of manufacturers of finished products of oil-proof synthetic rubber. —Thiokol Corp., Yardville (Trenton), N. J.

THERMOMETERS—Bulletin No. 600, title "Industrial Indicating Thermometers."—H-B Instrument Co., Inc., 2518 N. Broad St., Philadelphia.

THREADING MACHINE—Bulletin No. D-84, covering 1¼- and 2-in. pipe- and nipple-threading machines. — Landis Machine Co., Inc., Waynesboro, Pa.

TRACTOR — Bulletin 22, announcing Midget Shopmule tractor. — W. F. Hebard & Co., 551 W. Van Buren St., Chicago.

TRACTORS—Catalog, describing complete line of tractors, graders, and the like.—Caterpillar Tractor Co., Peoria, Ill.

TRAMRAIL — Folder, title "Transportation of Materials Overhead."—The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TRANSFORMERS — Bulletin No. GEA-897E, showing air-cooled transformers. —General Electric Co., Schenectady, N. Y.

TRUCK — Bulletin No. 108, on hydraulic lift truck.—Lyon Iron Works, Greene, N. Y.

VALVES—Three folders, No. 159 on regrinding, iron-body, gate valves, No. 160 on twin-bolt gate valves, No. 162 on bronze gate valves.—Jenkins Bros., 80 White St., New York.

VALVES—Bulletin No. 38, price list of valves. — Parker Appliance Co., Cleveland.

WATER COOLERS—Bulletin, showing line of water coolers.—General Electric Co., Schenectady, N. Y.

WATER COOLING—Two bulletins, on forced-draft, spray-cooling towers and atmospheric spray-cooling towers. — Binks Mfg. Co., 3106 Carroll Ave., Chicago.

ZINC POWDER—Booklet, title "Metallic Zinc Powder in Industrial Paint."—The New Jersey Zinc Co., 160 Front St., New York.

Books

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A.S.H.V.E. GUIDE, 1935

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. 962 pages, index, $5.

A reference handbook on heating, ventilating, and air conditioning. Contains 41 chapters of technical data, a catalog data section giving condensed engineering information on manufacturers' products, and an index.

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THE CHART OF PLENTY

Harold Loeb, director of the N.S.P.P.C., and associates. The Viking Press, New York. 180 pages, appendixes. $2.50.

A study of America's product capacity based on the findings of the National Survey of Potential Product Capacity. Gives statistical proof of the fact that an era of abundance is possible.

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GEORGE F. JOHNSON AND HIS INDUSTRIAL DEMOCRACY

William Inglis. Huntington Press, New York. 306 pages, illustrated. $3.

George F. Johnson's life and the development of the Endicott Johnson Corporation are the basis for this saga of four decades of labor-capital relations. Nineteen thousand employees, who can produce 175,000 pairs of shoes each day in 29 factories, are the beneficiaries of the industrial philosophy of this man who started as a bootmaker's apprentice.

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On the Calendar

MAY

13-16, Triple convention of American Supply and Machinery Manufacturers' Association, National Supply and Machinery Distributors' Association, and Southern Supply and Machinery Distributors' Association at Pinehurst, N. C. R. Kennedy Hanson, Secretary, American Supply and Machinery Manufacturers' Association, 604 American Bank Bldg., Pittsburgh, Pa.

13-16, National Fire Protection Association, annual meeting, Atlanta. Executive Office, 60 Batterymarch St., Boston.

20-23, National Association of Purchasing Agents, twentieth annual international convention and Inform-a-Show, New York. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York.

29 - November 11, California Pacific International Exposition, San Diego. Headquarters, Administration Bldg., Balboa Park, San Diego.

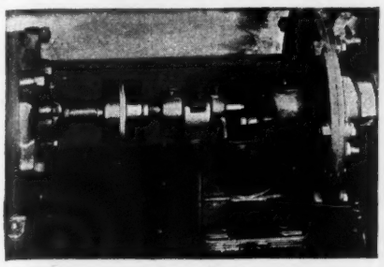
JUNE

17-19, American Society of Heating and Ventilating Engineeers, semi-annual meeting, Toronto, Canada. A. V. Hutchinson, secretary, 51 Madison Ave., New York.

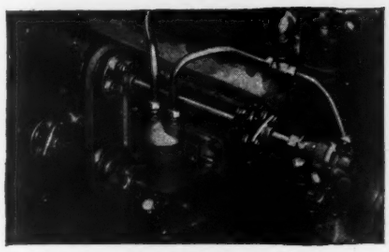
24-28, American Institute of Electrical Engineers, summer convention, Ithaca, N. Y. H. H. Henline, national secretary, 33 West 39th Street, New York.

POWER TRANSMISSION NEWS

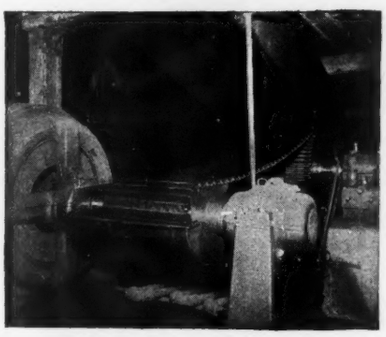
Morse Morflex Couplings are fast becoming popular with industry. Depending upon rubber as a flexing medium these couplings compensate for both angular and parallel misalignment with no measurable



loss of power. The above illustration shows Morflex Couplings with cover used in a large paint factory to connect an electric motor to a centrifugal pump.



Gasoline motor manufacturers are finding Morflex Couplings fit their exacting needs. Three Morflex Couplings are used on the above motor.



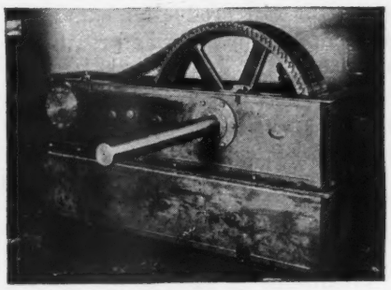
Large Morse Silent Chain installation driving fan in coal mine where sure reliable power transmission is absolutely necessary.

Use Chain Drives

Dependable transmission of power for every type of machine is made possible by the Morse Chain Company.

Chain Drives transmit power without loss, are economical in first costs and in operation and maintenance. Furthermore, they are adaptable to practically any conditions of power, speed or position.

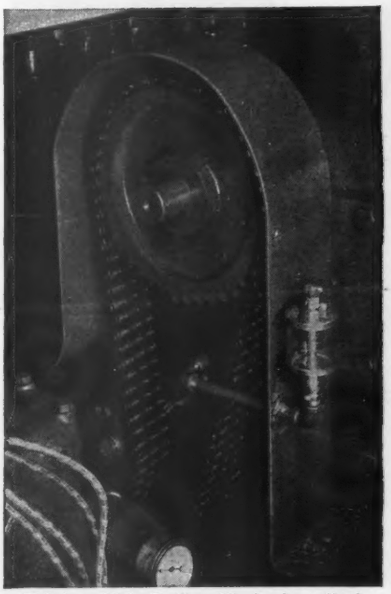
The Morse Chain Company maintains offices in the principal cities staffed with competent engineers who cooperate with industry in the development of more efficient power transmission.



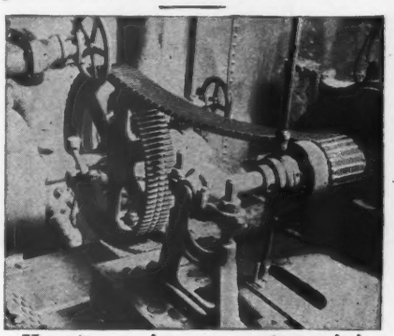
Morse Chain speed reducer with fabricated case—one of five units now successfully being used in large Eastern rubber mills. This type is available with single reduction in any speed ratio.

From Raw Material To Finished Product

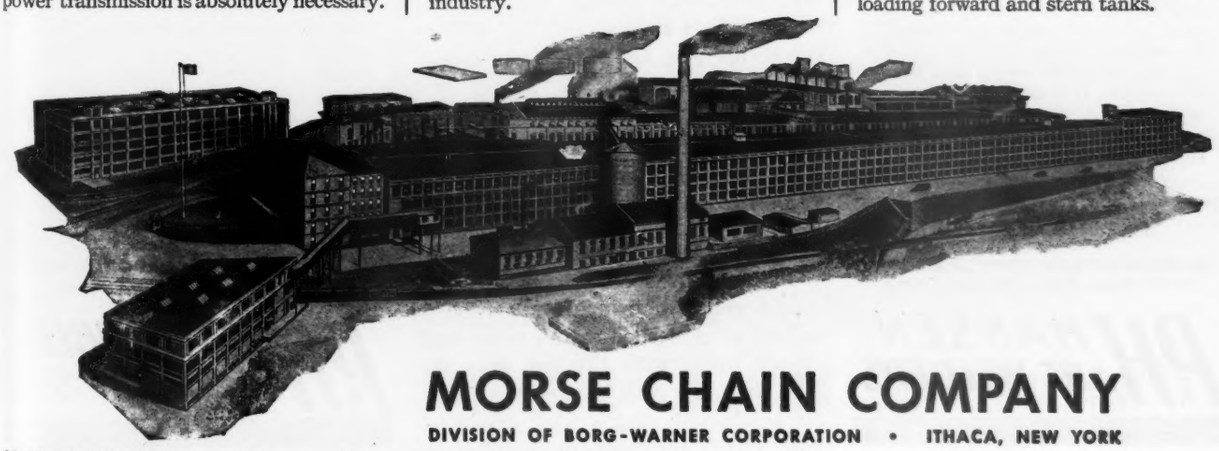
At the bottom of this page is an illustration showing the Morse Chain plant at Ithaca, New York, one of the largest in the world, devoted to the manufacture of power transmission devices. Here production is controlled from raw materials to the finished product. It is complete in every way, rolling mills, foundry, machine shop, complete steel plant, facilities for cold drawing, heat treating and the many other processes necessary for the production of Morse Silent Chains—Roller Chains, Morflex and Standard Couplings, Morse Improved Kelpo Clutches, Sprockets and other Morse Power transmission devices. Another large plant is maintained at Detroit to serve the needs of the automotive industry.



Triple width Roller Chain installation connecting gasoline motor with pump showing use of idler and method of lubrication. Because of the perfected and different construction of Morse Roller Chains, the lubricating oil penetrates to every moving part of the chain both inside and out.



Here is a unique power transmission installation. . . This illustration shows a Morse Silent Chain and Morse Pullmore Clutch between a gas engine and a 750-gallon per minute pump on a canal barge. A radial thrust bearing is mounted on supporting pedestal to eliminate an end-thrust and distortion due to unbalanced condition of barge when loading and unloading forward and stern tanks.



MORSE CHAIN COMPANY

DIVISION OF BORG-WARNER CORPORATION • ITHACA, NEW YORK

ADVERTISEMENT—*Each item on this page is a paid advertisement*

● As the electric arc crackles along, it is important that heat remain as nearly constant as possible to produce a welded seam of uniform strength. Current fluctuations produce uneven penetration.

That's why welding experts recognize the value of P&H-Hansen's stable arc, accomplished through the patented internal stabilizer winding. But it means more than uniform welds. It means easier, faster welding with less dependence on human skill.

Before you buy your next welder, get comparative oscillograph records. You'll see the difference.

Ask for Bulletin HW-3

HARNISCHFEGER CORPORATION
4525 W. National Ave., Milwaukee, Wis.

P&H HANSEN ARC WELDERS

We Must Make to Have

(Continued from editorial page 200)

•

were no wage cuts. On the contrary, the earnings of many of the men were increased.

In the first operation, a highly important one involving the use of expensive machines with high burden rates, labor cost was reduced $40,000 a year. This was accomplished by rearranging machines, by planning production to keep machines and men fully occupied, and by setting fair production standards. Incidentally, quality was greatly improved.

In one department similar changes plus a group bonus plan cut labor costs 36 per cent while earnings increased more than 30. Total annual saving was in excess of $30,000.

The Customers Complained

Conditions in an assembly department came to our attention because poor workmanship had brought complaints from customers. Our primary effort here was to improve quality but, as often happens, costs came down as quality improved.

Specifically, the cost of the assembly was reduced 1c. each. That may seem small, but it was a worthwhile percentage of the total, and amounted to $15,000 a year.

Another concern found itself in a bad competitive position due to NRA wage and hour restrictions.

The labor cost of the finishing operation on one of this concern's products was reduced from 26c. to 13c. In another operation, production had averaged 1,320 pieces per man-day, is now 2,400 without increased effort or fatigue. Total labor cost on another product has already been reduced 23 per cent, and under the bonus plan the men are making 5 per cent more. With further improvements now being put into effect it seems certain that in the near future costs will be down a total of 29 per cent, earnings up 15 to 20 per cent.

Incidentally, it is worth noting that the men displaced have not been discharged. Instead they have been employed on needed maintenance and repair work, with the full expectation that they will be absorbed back in productive work when reduced costs enable the company to get busi-

● It's a simple matter to correct those common misapplications when you have P&H Convertible Motors. Standard interchangeable parts quickly adapt them to your special requirements. They protect you against complete replacements . . . avoid long delays that might tie up production. Yet you pay no premium for it.

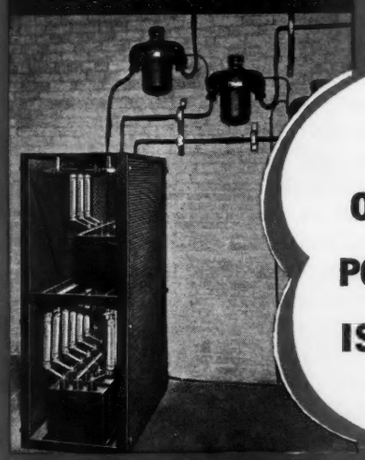
P&H Convertible Motors are offered in either Squirrel Cage or Slip Ring types, from ½ to 125 H. P.

New bulletins are available to give you full details. A post card will bring them.

HARNISCHFEGER CORPORATION
4525 W. National Ave., Milwaukee, Wis.

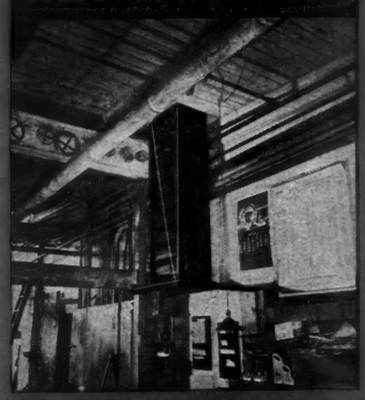
P&H CONVERTIBLE MOTORS

CLOTHING FACTORY



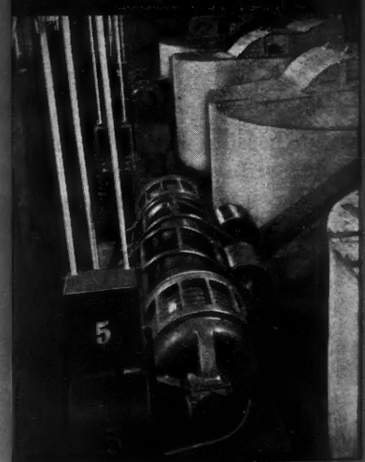
This G-E capacitor saves $55 a month. It paid for itself during the first 18 months

STEEL AND WIRE PLANT



This G-E capacitor earned enough to pay for itself in less than one year

PAPER MILL



This synchronous-motor drive earns a 34-per-cent return on the investment

IN HUNDREDS OF INDUSTRIAL PLANTS POWER-FACTOR IMPROVEMENT IS REDUCING POWER COSTS

IN HUNDREDS of widely diversified industries, the installation of G-E power-factor-improving equipment—capacitors, synchronous motors, synchronous condensers—has improved plant operation and effected savings. In many of these cases, where power contracts included a penalty for low power-factor and a bonus for power-factor improvement, a substantial return was made on the investment. A few of these installations are illustrated here.

The installation of G-E power-factor-improvement equipment will result in more efficient and more economical operation of your plant and, if your power contract contains a power-factor adjustment clause, will effect substantial savings in your power costs.

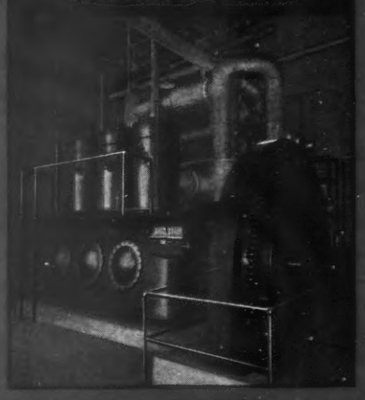
We shall be glad to assist you in selecting the proper equipment. Call the nearest G-E sales office or write to General Electric, Dept. 6L-201, Schenectady, N. Y.

360-105

OIL COMPANY

This G-E Pyranol capacitor installation returns 36 per cent annually on the investment

PACKING PLANT



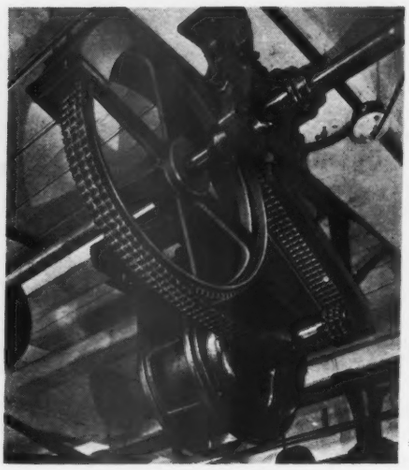
This synchronous-motor drive saves $1800 annually in power costs

COAL MINE

This synchronous motor brings a 138-per-cent return on the investment

GENERAL ELECTRIC

A SUGGESTION for *Short Center Drives*



This Baldwin-Duckworth triple width compound roller chain has been transmitting power from this 10 H.P., 1200 R.P.M. motor for years. No power loss, no stretching problem, no lubricating problem, long life—and **low first** cost.

Roller chain power transmission is the ideal solution for many a vexing drive. And Baldwin-Duckworth machine finish roller chain and accurate-cut sprockets afford a flexibility and length of life that amazes even those who have been long users of roller chain.

Send for the Baldwin-Duckworth Chain book. It gives data that insures the right selection of chain for every job. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

BALDWIN-DUCKWORTH

Lower . . maintenance costs— fewer Repairs

LANCO

MOLDED RUBBER Wheels

With Hyatt Roller Bearings and Zerk Oilers

Trucks equipped with them save man power, pull easier, save concrete or wood floors—and repay their initial cost rapidly. Gives more mileage to gasoline or electric tractors. Gives quiet operation, increases workers efficiency.

WOODRUFF DEMOUNTABLE RUBBER WHEELS 8" & 16" Overall Diam.

Rubber tread of these wheels is vulcanized or molded directly to face of wheels—rubber tread *cannot* come off. When worn down to iron wheel, new tires are molded on. Made in sizes from 6-in. to 14-in. overall diameters. Get complete information and new low costs—*today*.

LANSING COMPANY

LANSING, MICHIGAN

Chicago Kansas City Minneapolis San Francisco New York Boston Philadelphia

Dolph's

CHINALAK

BLACK BAKING VARNISH

— — has proven its ability to cut maintenance costs

Why continue to experiment with insulating varnish in your repair shop? Today you can eliminate all chance by standardizing on DOLPH'S CHINALAK Black Baking Varnish—a varnish that has definitely proven its ability to reduce maintenance costs.

As a result of over a quarter of a century's research and experimentation DOLPH Varnishes now offer the utmost in dependable, long-lived motor protection.

Specify DOLPH'S CHINALAK on all your rewinding jobs and enjoy freedom from motor breakdown which entails disrupted production and added maintenance expense.

Complete details on this and other DOLPH Products will be furnished on request.

JOHN C. DOLPH CO.

Insulation Specialists

166 Emmett Street, Newark, N. J.

ness that formerly it could not afford to take.

Let us turn to material waste for a moment. In one textile concern 40 per cent of finished product had to be sold as seconds at a considerable loss. By installing a modern inspection program the percentage dropped to 18 in a month's time. Again, the most important department in one concern—a bottle neck that controlled the production of the entire plant—was supposed to have a normal capacity of 700 units per day with a maximum of 1,600. But when the maximum was reached, goods became hopelessly lost. It was impossible to assemble orders properly and make shipments on time. A large force was maintained mainly to search for mislaid goods. Even so, additional goods frequently had to be manufactured to fill the orders.

After the introduction of a planning and scheduling department and the institution of a wage incentive plan, normal output rose to 2,200 units without the need for factory tracers. Everything runs smoothly. Shipments go out on time.

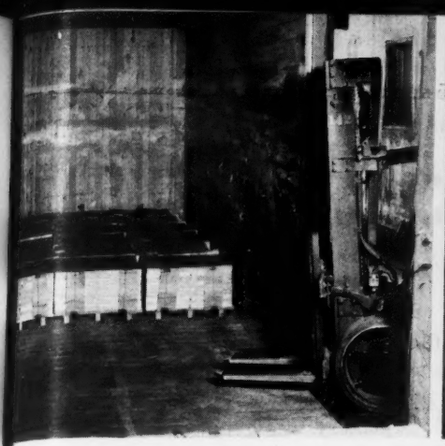
For a medium-sized operating concern losses which had finally reached $200,000 annually were, within one year, turned into a profit of $280,000.

This was accomplished by setting up a reasonable budget based upon sales and inventory forecasts, and proper standards of factory and selling costs—*and then living up to the budget.*

Increasing Consumer Buying

In many cases these cost reductions have been the means of saving shaky concerns. In others they have made it possible for companies to compete with their more efficient competitors under present wage and hours regulations. That alone is reason enough to fight waste.

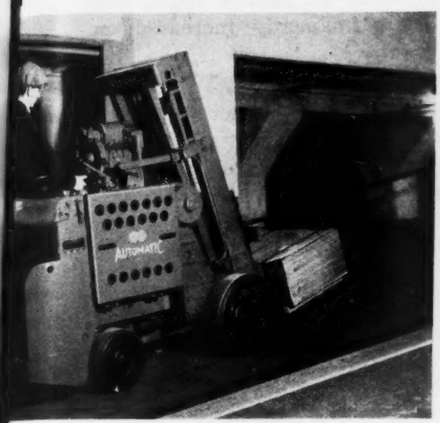
Aside from the immediate value, however, that such cost reductions have for the one who accomplishes them, it must be remembered that they have a wider significance economically and socially. Only as many concerns are able to pay high wages and keep costs down so as to make increased consumer buying possible, can business and the people as a whole enjoy again the prosperity we have tasted in the past. If everyone does everything possible to eliminate waste, we may see greater prosperity than ever before.



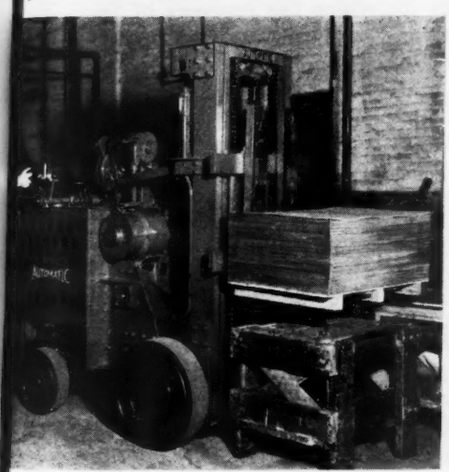
Entering box car

2 *Negotiating narrow car door in one swing by means of rear wheel steer and front wheel drive*

3 *Breaking out car. Note removal of tin plate bundle from first row corner*



4 *Climbing steep ramp to storage with load tilted.*



5 *Placing bundles on feeder tables*

6 *Stacking five bundles high in storage. Collapsed height of 80" provides 99" total lift*

● *High speed of travel and lift a feature.*

MODERN TIN PLATE HANDLING··· *with* "AUTOMATIC"

FRONT WHEEL DRIVE – TELESCOPIC TILTING FORK TRUCK

● *This model available in capacities from 1,750 lbs. to 7,000 lbs. equipped with forks of proper length to suit requirements.*

"AUTOMATIC" Tilting FORK TRUCKS make it possible to load, unload, transport and stack tin plate, as well as the products made of tin plate, speedily, efficiently and economically.

This front wheel drive "AUTOMATIC" affords a most modern and dependable truck for a wide variety of industries because it can be adapted to all phases of raw and finished material handling by means of the pallet system. Scoops can be installed for handling rolls of paper; chisel nose forks for baled paper, pulp, or cotton; special forks and pallets for bagged sugar, flour, salt, grain, etc.; dump bucket for loading and unloading bulk products; rams for reels of wire; straddle forks for pig lead, bar copper, etc.; special thin forks for crated refrigerators, crated stoves; clamp forks for barrel handling. Canned goods in cartons, case goods, crated products, all can be handled in unit loads and stacked to ceiling height with inexpensive pallets and this versatile machine.

AUTOMATIC TRANSPORTATION COMPANY

DIVISION OF THE YALE & TOWNE MANUFACTURING CO.

39 WEST 87th STREET CHICAGO, ILLINOIS

Speed the flow of materials, increase the load-per-trip and miles-per-hour, reduce your handling costs, eliminate costly maintenance—do it with "AUTOMATIC." Write for details.

Elevating Platform Trucks
High Lift Trucks
Telescopic Trucks
Tilting Fork Trucks
Tractors
Locomotive Crane Trucks
Die Handlers
Ram Trucks
Bosh Trucks
Roll Handlers
Reel Handlers
Furnace Chargers
Load Platform Trucks
Baggage Trucks
Sheet Handlers
Container Trucks
Special Crane Trucks
Sugar Crushers
Tin Plate Trucks
Hopper Trucks

AVAILABLE IN CAPACITIES UP TO 50 TONS

TRADE **AUTOMATIC** MARK

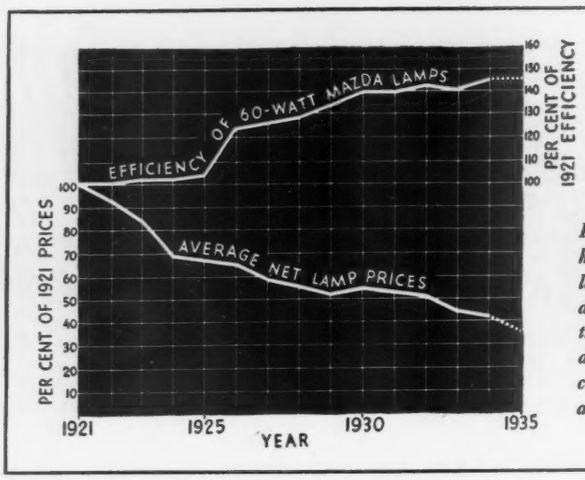
Electric

MATERIAL HANDLING EQUIPMENT

• THE REASON FOR LOW COST TRANSPORTATION •

2½ times

AS MUCH LIGHT FOR YOUR DOLLAR



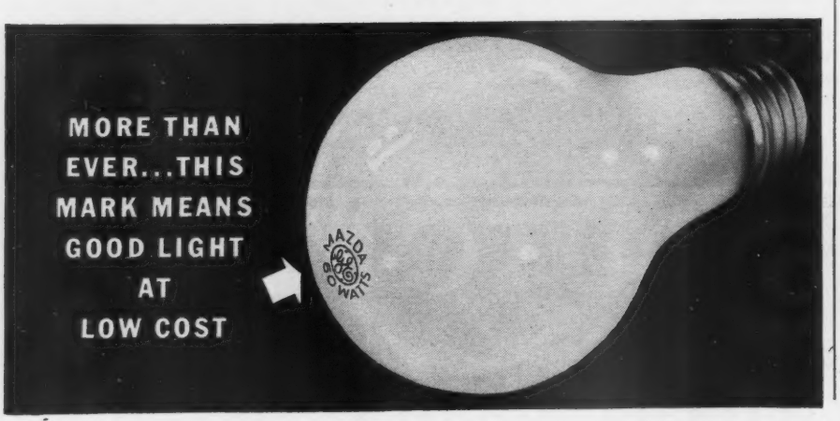
Here you see graphically how the price of MAZDA lamps has gone steadily down, while efficiency... the amount of light produced per unit of current consumed... has gone up and up.

ON APRIL FIRST, General Electric announced its seventeenth major reduction in MAZDA lamp prices in fifteen years. The cuts are drastic . . . 25 per cent on popular low wattage lamps, and as much as 30 per cent on larger sizes.

But far more important to you is the improvement in lamp efficiency, made possible by continuous laboratory research and development. The user of a 60-watt MAZDA lamp today gets two and one-half times as much light for his money as he did from the same size lamp in 1921. Much the same comparison holds true for other sizes.

With lighting costs at the lowest level in history, why not give your employees all the light they need for effective work? Your local lighting company will be glad to survey your plant. Or write to General Electric Company, Department 166, Nela Park, Cleveland, Ohio.

GENERAL ELECTRIC



Now to Get the Money

(Continued from editorial page 206)

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of filing the final application. Typical examples among them are reported as follows:

1. A bakery was granted a loan of $15,000 for general overhaul and enlargement of baking plant, leading to permanently increased employment.

2. A bleachery was granted $100,000 for machinery, pipe-line and vat replacements, and for motorization of the power transmission system. As the work will take some time, a permanent increase in the maintenance force will be made.

3. A manufacturer of roofing was granted $150,000 for a plant addition necessitated by the increased demand for the product and caused in part by the growing volume of building modernization.

In each case there were other purposes for which the proceeds of the loan were required. In this connection it should be understood that *all* the purposes of the applicant must be definitely and distinctly stated in Exhibit A, Form L 173, together with the percentage of the total amount represented by each.

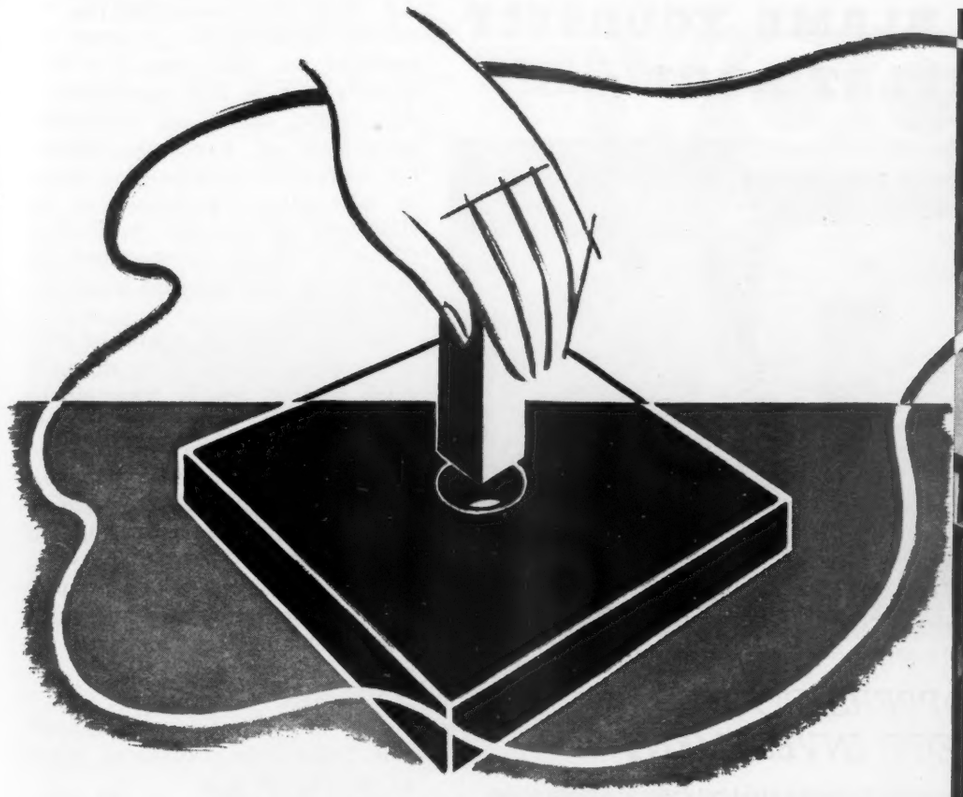
Employment the Primary Concern

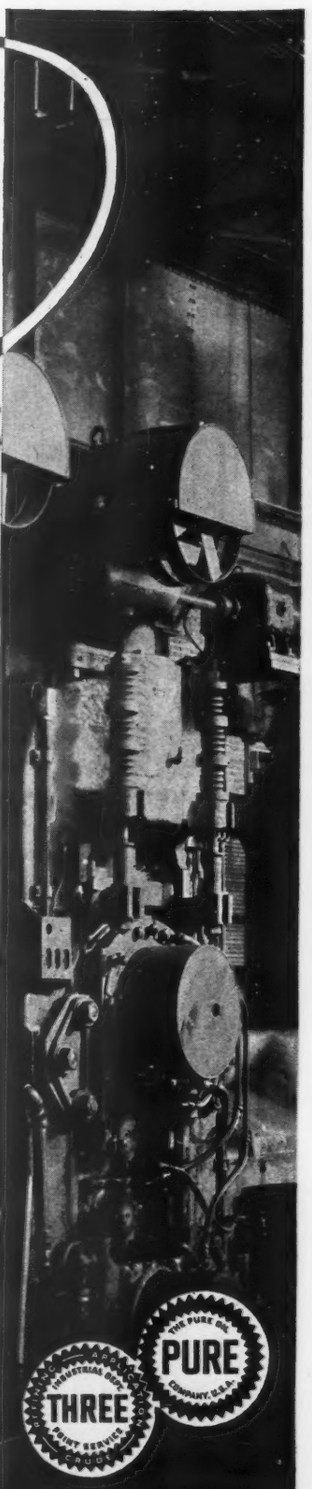
The percentage to be devoted to the rehabilitation or replacement of plant and equipment may vary considerably and still meet with the approval of the RFC. *The most definite guide to the probability of approval of a considerable rehabilitation program is the amount of additional employment it will provide.* This is the Corporation's primary concern in approving its loans to industry. It is well for the applicant to furnish a definite program of carrying out his rehabilitation plans with specific indication of the additional employment provided at the several stages of progress.

Now, as to the requirements which must be met in order to qualify for a loan:

The applicant must be solvent at the time of disbursement of the loan; he must have applied to his local bank for a loan and been refused, and he must be able to provide acceptable security.

Amended Section 5d of the RFC





"A SQUARE PEG WON'T FIT A ROUND HOLE"

—Neither will one industrial lubricant fit all conditions. PURE OIL'S THREE POINT SERVICE insures the proper lubricant being selected for each specific use. Maximum protection and economy at minimum cost.

1 Pure Oil Crude comes from many types of oil fields in nine states. Some types of Crude are better adapted to certain uses than are others. Pure Oil, having a wide selection of Crudes, can better serve you by specifying the lubricant refined from the correct type of Crude for your particular lubrication need.

2 Good refining is vital. All types of Crudes must be correctly refined to prevent loss of inherent lubricating values. Pure Oil's modern refining methods, especially adapted to each type of Crude, preserve and improve the lubricating qualities of Pure Oil superior Crudes.

3 Scientific application is equally important. Good Crudes properly refined go for naught unless skilled engineering selected the type of lubricant best adapted to your particular problems. Pure Oil Engineers are thoroughly familiar with lubrication, its requirements, and its problems.

Consult a Pure Oil industrial engineer for practical means of *decreasing* lubrication costs and *increasing* lubrication safety.....

If you are interested in wire ropes and their lubrication, we suggest you write for our Mechanical Bulletin No. 50.....

THE PURE OIL CO.

U. S. A.

PRODUCERS, REFINERS, MARKETERS OF A COMPLETE LINE OF PETROLEUM PRODUCTS

from now on, **BLAME YOURSELF IF YOUR FLAT ROOF** *fails!*

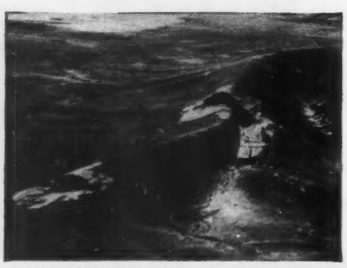
A roof (NOT tar) being taken off after only 9 years of service.

KOPPERS ROOFS PROTECT INVESTMENT

This nation today is going painfully through a vivid but expensive lesson about roofings. Millions of dollars have been invested in roofs which are failing in a fraction of their expected life. Hundreds of millions of building investment money is being endangered by roofings that cannot keep out the elements.

This situation arose from the use of other materials in place of genuine old style coal tar pitch. For generations, pitch roofs have been lasting 20—30—40 years. But many of those *other* roofs fail in four to eight years. Today, many roofers are refusing to put anything but coal tar pitch on flat roofs. If you have any flat-roofed buildings, send for the folder "Do's and Dont's" which shows what happens to roofs and why. If you have a re-roofing job get in touch with us. 10-15-20 year Bonds can be furnished.

KOPPERS PRODUCTS COMPANY
KOPPERS BUILDING PITTSBURGH, PA.



This roof (NOT tar) completely ruined in seven years.

This roof (tar) in fine condition after 24 years (Lonsdale, R. I.)

"Koppers products protect"

Tarmac Road Materials
Wood Preservatives
Roofing Pitches
Roofing Felts
Waterproofing
Industrial Pitches
Crude and Refined Tars

KOPPERS
ROOFS LAST

Tar Base Coatings
Tar Base Paints
Pitch Coke
Tar Acids
Benzol
Naphthalene
Agricultural Products

These and other Koppers Products have won a lasting place in hundreds of industries.

Act reads that loans shall be "so secured as reasonably to assure repayment of the loans." Such security may be first mortgages on real estate, plant, and equipment, assignment of warehouse receipts for marketable merchandise stored in satisfactory warehouses, or assignments of current receivables. Character of the management and prospective earnings are given due consideration.

Second mortgages, shares of stock of corporate applicants, or shares of stock without readily ascertainable market value, franchises, patents, good-will, or foreign securities are not usually considered satisfactory primary security. Neither are assignments of orders nor pledges of inventories.

Substantiating data to accompany the final application are quite extensive, including the following exhibits:

A. General information as to history and operations of applicant.

B. Description of collateral offered as security for loan.

C. Comparative statement of condition.

D. Comparative statement of income and expense.

E. Current financial statement as of a date not over 30 days preceding date of application.

F. Proposed note.

G. Certified copy of resolution of applicant's board of directors or certificate of partnership.

H. Authorization to constituted authorities.

I. Agreement and schedule relating to salaries and other compensation.

J. Agreement as to compensation of services in connection with application.

K. Certified copy of charter, bylaws and regulations of corporate applicant or partnership agreement.

L. Audit of applicant, certified by independent accountants as of date not more than six months preceding date of application.

M. If statements and audit, *C, D, E,* and *L,* are not upon a consolidated basis, an independent audit of each subsidiary.

N. Independent appraisal made within six months of date of application, indicating separately the value of property offered as collateral in *B.*

Exhibits *C, D, L,* and *M* may

be omitted from applications for $10,000 and less.

The general meaning of the exhibits is fairly clear, but there are definite provisions attached to each that require thorough study and careful consideration.

The requirements may appear to be strict but, considering that an RFC loan to industry is one which must have been declined by a bank, it does not appear that they are too rigid. Indeed they offer an unparalleled means of readily financing not only plant rehabilitation but business expansion as well.

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How Do You Buy?

(Continued from editorial page 187)

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case stories that have come to my attention.

There is the large packing company that turns its supply stock 22 times per year and, as a result, must charge only $2.36 for storage facilities against every $100 worth of merchandise handled.

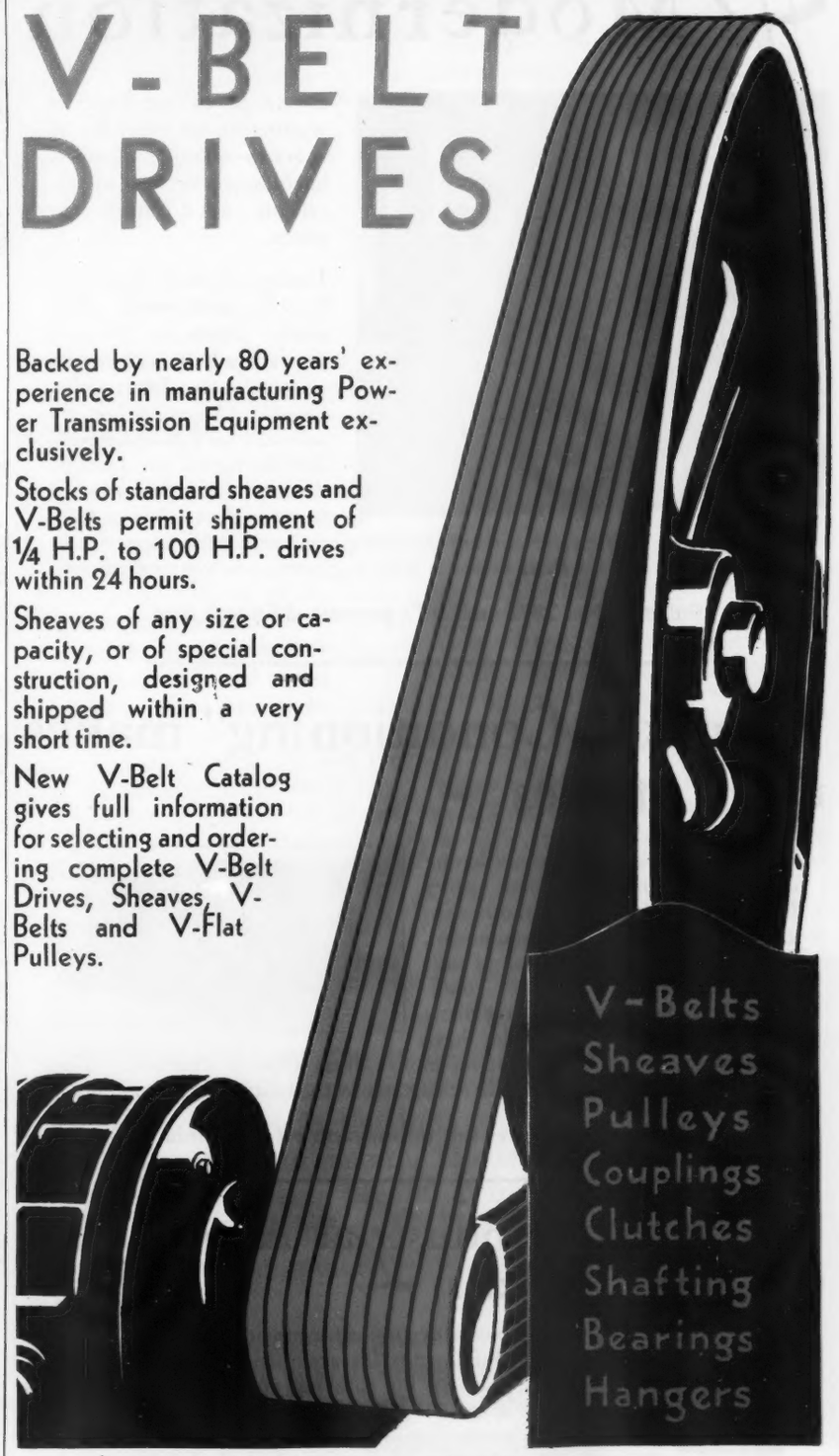
To compare with this enviable condition, there is a municipal institution which turns its stock but 2.8 times a year and must charge $5.56 per $100 worth of supplies for storage facilities in spite of the fact that small rent is paid and no taxes are figured in the cost.

Another illustrative case is that of the manufacturer who brought out a new steam trap. He sold it for the low price of $5, and claimed that he would have had to charge twice as much if he had been unable to market it through distributors located strategically throughout the country.

Some distributors introduce as many as 200 new and improved products per year. The average for all distributors is 20. If, in each case, the cost to user is only half what it would be by direct selling, the saving is indeed important.

As I said when I began, I am proposing that each manufacturer who uses industrial supplies look into the evidence and then decide his buying policies for himself. A fair conclusion seems to be that most users of industrial supplies will find the industrial distributor to be an institution of direct assistance in keeping the manufacturing costs low. Many important users have.

WOOD'S
V-BELT DRIVES



Backed by nearly 80 years' experience in manufacturing Power Transmission Equipment exclusively.

Stocks of standard sheaves and V-Belts permit shipment of 1/4 H.P. to 100 H.P. drives within 24 hours.

Sheaves of any size or capacity, or of special construction, designed and shipped within a very short time.

New V-Belt Catalog gives full information for selecting and ordering complete V-Belt Drives, Sheaves, V-Belts and V-Flat Pulleys.

T. B. WOOD'S SONS CO.
CHAMBERSBURG, PA.
50 Church St., New York City 387-391 Atlantic Ave., Boston
MEMBER: The Mechanical Power Engineering Associates

NRA MEMBER U.S. WE DO OUR PART

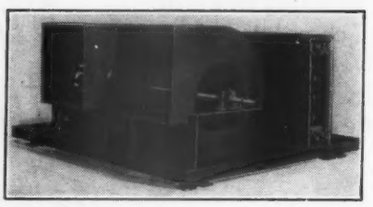
$ *from* Power Plant Modernization

Many an ancient boiler is wasting money every day it operates—many a plant is handicapped because of unreliable and insufficient steam.

Leaders in many industries have modernized their power plants in the past year and a half, with results in some cases almost unbelievable. Since the best results call for fine equipment, Buffalo forced and induced draft fans have been selected in more than a few of these modern plants. High air-moving efficiency combined with rugged construction make Buffalo Fans favorites with engineers, erectors and owners.

Bulletins No. 2872 and 2873 present additional data

"Comfort Conditioning" makes rapid strides —



The advantages of air conditioning are becoming more apparent every day, as one business after another installs comfort conditioning equipment. Buffalo builds a complete line of unit coolers, air washers and unit conditioners. Buffalo engineers have many years experience in the field, have provided the proper equipment for almost every type of structure. They will be glad to work with you in fitting comfort conditioning to your needs.

Bulletin 2968 gives full information on these units

Hundreds of Industrial Applications for Spray Nozzles —

Non-clogging, fine-spraying—these two piece Buffalo nozzles are used in every branch of industry for spraying anything which can be sprayed. Complete range of sizes always ready for stock shipment, male or female thread. All sizes may be had of any materials.

Bulletin 481 lists sizes and materials

BUFFALO FORGE COMPANY

471 Broadway Buffalo, N. Y.

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Where Layout Is Right

(Continued from editorial page 203)

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It works something like this: When a salesman comes in at night he slides his empty trays into his own bin. At night his orders are packed in the trays and put back in the bin. Then when he comes in early in the morning, he has merely to transfer the loaded trays to his truck. There are a couple of dozen trucks, so this loading plan is a tremendous help in getting them away on schedule.

Another point about the conveyor. The free rollers are important. If for any reason the trays pile up on the far end, the rollers turn harmlessly under them. And the fact that they turn free makes it possible for the shipper to move loaded trays back against the line of travel to the bins for which they are destined. Otherwise he would have to pick them up and carry them. A loaded tray is not so heavy. The hundredth tray he picked up would not be so light.

There has been only incidental reference to the air-conditioning in this bakery, because it is standard practice in the industry to condition fermentation rooms. There has been no emphasis on the many controls that assure a uniform quality product. Again, standard practice. This has been rather an attempt to show where the Williams Bakery has improved upon standard practice, mainly in the economical, even sparing use of equipment, and in the perfection of a few details of plant layout, which lead to the maintenance of a steady flow of production and to low-cost operation. It actually takes 11 men to operate the plant, and hourly production will run 2,000 loaves. It could be done with nine.

One further point. The plant does not look its age. A well-conceived maintenance plan takes care of that. Lighting is a trifle better than it needs to be. Painting can never be too good in any plant, is close to perfection here. White paint on equipment, walls, ceilings. A pleasing green for dados.

To which you say, "Of course, a food plant *has* to be light and clean."

About the only reply we can think of is that there are many industrial plants that ought to be both, but, unfortunately, are neither.